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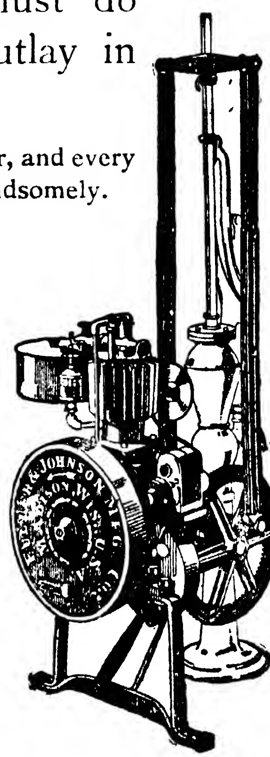

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Agricultural Gazette of New South Wales.

Field Experiments With Maize.

GRAFTON EXPERIMENT FARM, 1919-20.

E. S. CLAYTON, Experimentalist.

THE early portion of the season was very dry, and very little rain was received during the spring, but splendid rains were experienced during the hot summer months, resulting in good yields from the late-sown maize crops. The incidence of the rainfall was as follows:—

1919.	Points.	1920.	Points.
July ...	31	January	555
August	43	February	266
September	6	March	357
October	125	April	293
November	164	May ...	283
December	505	June ...	179

No extremely high summer temperatures were recorded. Harvesting operations were delayed by continued rain towards the latter part of the season.

Hilling v. Flat Cultivation.

Flat cultivation is practised by many farmers, others hill with the plough, and some farmers have recently used the disc cultivator for hilling maize. The object of this experiment was to obtain data regarding the merits of these different methods of cultivation.

The experiment was situated on the black alluvial soil of the farm. The land had previously been occupied by a crop of wheat, which delayed its preparation until October, when it was ploughed 8 inches deep with a disc plough and cultivated three times with a disc cultivator. The soil worked into very fair tilth, considering the lateness of the preparation.

Leaming maize was sown on 18th November, with a maize-dropper, in rows 4 feet apart, three grains being dropped every 40 inches; two small mouldboards were adjusted on the front of the machine, so that the seed would be deposited on the moist soil below the surface. On account of the land being previously occupied by a wheat crop, and the consequent delay in preparing the soil for the maize, germination was not quite satisfactory.

The crop was rolled with a light roller on 12th December, and cultivated with a single-horse implement on 13th December, and the cultivations were continued at frequent intervals to conserve moisture and destroy the vigorous weed growth. The single-horse cultivator, of course, takes longer than the two-horse implement, but much cleaner work can be performed with the former. The cultivations were the same throughout all the plots, with the exception of the methods of hilling; hilling was carried out when the plants were about 2½ feet high. None of the plants showed any tendency to lodge. The

main benefit derived from the hilling was the smothering of the weeds in the rows, and this was effectively done by both the plough and disc cultivator. The plot hilled with the disc cultivator presented the cleaner appearance, and fewer roots were damaged in the process than in the case of the plot hilled with the plough. Sixty-three points of rain fell between 18th and 30th November, making the total up to the end of April, 2,039 points. The crop was harvested 2nd July with results as follows:—

Treatment.	Yield per acre.	Increase or decrease due to treatment.	Value of increase or decrease.	Cost of increase or decrease.	Net gain.	Net loss.
	bus. lb.	bus. lb.	£ s. d.	s. d.	£ s d.	£ s. d.
Hilled with disc cultivator.	48 41	+3 55	+1 11 10	4 0	1 7 10	......
Flat cultivator	44 42	......	......	......	......	......
Hilled with plough ...	42 19	−2 23	−0 19 3	6 0	......	1 5 3

+ Indicates plus. − Indicates minus.

Maize was reckoned at 8s. per bushel, the cost of hilling with a disc cultivator at approximately 4s. per acre, and the cost of hilling with a plough at 6s. per acre. The result of the experiment shows that hilling with a disc cultivator resulted in a net gain of £1 7s. 10d. per acre, and hilling with a plough occasioned a loss of £1 5s. 3d. per acre.

Experiment with De-suckering.

The aim of this experiment was to obtain data regarding the merits of de-suckering—that is, removing the suckers. The value of the increased yield (if any) caused by removing the suckers must be set against the cost of the extra labour involved, and the value of the green fodder obtained by removing the suckers must also be taken into consideration.

The experiment was situated on black alluvial soil. The land was ploughed 9 inches deep with a disc plough early in July and allowed to lie in the rough for five weeks; it was then cross-ploughed to a depth of 5 inches and harrowed down. The disc cultivator was used after every fall of rain sufficiently heavy to cake the surface of the ground. Moisture was thus conserved and weeds destroyed.

The soil was in ideal condition at the time of planting. Leaming, a variety which suckers rather freely, was planted with a maize-dopper on 17th December, in rows 4 feet apart, three grains being dropped every 40 inches. The land had been thoroughly prepared and the soil was well supplied with moisture, consequently the germination was excellent. The experiment consisted of two plots, each half an acre in area.

Cultivation was commenced early. All weeds were kept in check and moisture conserved by the frequent use of the single-horse cultivator.

As the crop suckered freely, considerable time was occupied in de-suckering. The area of the plot suckered was half an acre, one man taking five hours to complete the operation. With labour at 1s. 7d. per hour, the cost of suckering in this particular instance was at the rate of 15s. 10d. per acre. The untreated plot yielded 70 bushels 34 lb., and the suckered plot 69 bushels 55 lb., so that the result was a loss of 35 lb. maize. It was estimated that 1 ton of greenstuff per acre was obtained by de-suckering. Maize was valued

at 8s. per bushel and the greenstuff at 15s. per ton. This makes the value of the increase 15s. for greenstuff minus 5s. for maize, or a net gain of 10s. As the cost of treatment was 15s. 10d., the total result of de-suckering was a loss of 5s. 10d. per acre.

Deep v. Shallow Cultivation.

The aim of this experiment was to determine what depth of cultivation gives the highest yield of grain.

The preparation of the land and the sowing details were identical with those of the hilling *versus* flat cultivation experiment. The crop was sown on 19th November, Leaming being the variety of maize planted.

The cultivations were commenced on 13th December; they were all given on the flat, and were continued until tasselling time. The plots receiving shallow cultivation (2 to 3 inches deep) presented a fairly clean appearance; the cultivations were apparently sufficiently deep to check weed growth and to maintain an effective soil mulch without damaging the roots of the maize plants. The plot receiving deep cultivation (5 inches deep) presented the cleanest appearance throughout: all weed growth was destroyed, but the roots of the maize plants were certainly damaged in the process, especially toward the later stages of growth, the effect being visible to a small extent in the growing crop. The plot receiving deep cultivation (5 inches deep) till the plants were about 15 inches high, and then shallow cultivation (2 to 3 inches) until tasselling, presented much the same appearance as the plot receiving shallow cultivation throughout. The crop was harvested on 20th August.

Treatment.	Yield per acre.	Increase or decrease due to treatment.	Value of increase or decrease.	Cost of increase or decrease.	Net gain.	Net loss.
	bus. lb.	bus. lb.	£ s. d.		s. d.	£ s. d.
Deep cultivation then shallow	43 16	+ 0 24	+0 3 5	Nil.	3 5	...
Shallow cultivation	42 48	...	...	...	...	...
Deep cultivation throughout...	39 10	– 3 38	–1 9 5	Nil.	...	1 9 5

+ Indicates plus. — Indicates minus.

Maize was valued at 8s. per bushel: the difference in cost between deep and shallow cultivation was practically negligible. The experiments showed that deep cultivation till the plants were about 15 inches high and then shallow cultivation till the time of tasselling resulted in a net gain of 3s. 5d. per acre over shallow cultivation throughout. Deep cultivation throughout resulted in a loss of £1 9s. 5d. per acre.

Green Manuring Experiment.

The aim of this experiment was to determine which is the most suitable green manure crop to grow in a crop of maize to maintain or increase the fertility of the soil when maize is grown year after year.

The land had previously been occupied by a crop of wheat, and this delayed the preparation for the maize crop. Ploughing was commenced on 5th November; the land was then rolled and harrowed, the disc cultivator was used on 18th November and again on 28th November, and the area was then cross-harrowed prior to sowing.

Improved Yellow Dent was sown with a maize-dropper on 18th December in rows 4½ feet apart, three grains being dropped every 40 inches. No fertiliser was applied. The germination was excellent throughout the experiment, and the crop made splendid growth.

Thorough cultivation was given, and the crop always presented a very clean appearance. The maize was hilled with a disc hiller, and the cultivations were continued until 5th March, when the maize was tasselling; the green manure crops were then drilled in between the rows of maize. Grey field peas, rape, and vetches were the green manure crops tried. The rates of seeding were as follows:—Field peas, 12 lb. per acre; vetches, 10 lb.; rape, 1½ lb. With the exception of the rape, the green manure crops germinated well. The best growth was made by the field peas, which grew exceptionally well between the rows of maize.

As this experiment was inaugurated in 1919, this season's crop is simply the foundation for the experiment; next season's results should show the effect of the various green manure crops (grown and ploughed-in this season) on the yield of maize. At the same time, the results shown here indicate that the yields of maize are not materially affected by catch crops sown at tasselling stage. The maize was harvested on 3rd August.

Treatment.	Yield per acre.	
	bus.	lb.
Maize with rape sown at tasselling stage ...	69	52
Maize with Grey field peas sown at tasselling stage	68	11
Maize alone	66	30
Maize with vetches sown at tasselling stage ...	63	25

The cost per acre of producing the green manure crops was:—Rape, 4s. 8d.; field peas, 6s. 4d.; vetches, 6s. 10d. Labour was valued at 1s. 8d. per hour, field peas 15s. per bushel, rape 11d. per lb., vetches 21s. per bushel. These figures will be charged against the maize crop next season.

Late Cultivation Experiment.

This experiment was carried out with the idea of comparing the yield of maize cultivated up to tasselling time with that of maize receiving only one cultivation after hilling. The preparation of the land and the details of sowing were identical with those of the suckering experiment. Leaming maize was sown on 18th November; the soil, having received thorough preparation, was in good tilth; consequently the germination was excellent, and the crop made splendid growth.

The season was moist, consequently weeds were troublesome, and the cultivator had to be frequently used to check their growth. The first cultivation was given three weeks after planting, and three cultivations were given before hilling. This latter operation was carried out when the crop was about 18 inches high; one cultivation was then given throughout to clean

out the "middles." Up to this stage all the plots received exactly the same treatment. One plot thereafter received no further cultivation; the others received two more cultivations—that is, they were cultivated up to tasselling time. These plots were quite free from weeds at harvest time, and presented a much cleaner appearance than the plots receiving only one cultivation after hilling. The crop was harvested early in July.

Treatment.	Yield per acre.	Increase due to treatment.	Value of increase.	Cost of increase.	Net gain.
	bus. lb.	bus. lb.	£ s. d.		£ s. d.
Cultivated to tasselling	68 36	5 20	2 2 10	Two cultivations, 10s.	1 12 10
Only one cultivation after hilling	63 16	...	...	......	...

Maize was valued at 8s. per bushel, and the cost of a single-horse cultivation between the rows was reckoned at 5s. per acre. The results show that an increase of £1 12s. 10d. per acre was obtained by cultivating the maize right up to the time of tasselling, instead of ceasing cultivation after hilling.

Rate of Seeding Experiments.

The object of these experiments was to determine what rate of seeding gives the highest yield of grain. Two varieties of maize were used to conduct the trials—Leaming and Improved Yellow Dent. In both experiments, maize was valued at 8s. per bushel, and seed maize at 12s. 6d. per bushel.

Leaming Experiment.—The land was ploughed 8 inches deep in July, and the disc cultivator was used to conserve moisture and destroy weed growth. The winter was very dry; the rainfall for the months of July, August, and September was 31, 43, and 6 points respectively. The land was re-ploughed in September. Very little weed growth appeared after this second ploughing, and the land was cultivated only after every fall of rain sufficiently heavy to cake the surface of the ground. The land was cross-harrowed on 13th November, and the experiment was planted with a maize-dropper on 17th November in rows 4 feet apart at the following rates of seeding:—

Distance apart.	Grains per Acre.	lb. per Acre.
3 grains every 40 inches... ...	9,801	6·5
3 ,, 32 ,, ...	12,251	8·1
3 ,, 28 ,, ...	14,001	9·3
3 ,, 20 ,, ...	19,602	13·0

There are 1,508 grains of Leaming to the lb. No fertiliser was applied to any plot. The soil was in ideal condition, and the germination was excellent throughout the experiment. Cultivation between the rows was commenced on 8th December, and all weed growth kept in check by frequent cultivations until the maize tasselled. Twenty inches of rain fell during the growing period of the crop, consequently the growth was exceptionally good, especially on the thickly seeded plots. The more thickly

seeded plots did not sucker so freely as those sown at the thinner rates of seeding. The crop was harvested early in July.

Treatment.	Yield per Acre.		Increase due to treatment.		Value of Increase.			Cost of Increase.	Net Gain.		
	bus.	lb.	bus.	lb.	£	s.	d.		£	s.	d.
3 grains every 28 inches	88	29	12	12	4	17	8	2·8 lb. seed extra, 7d. ...	4	17	1
3 ,, 20 ,,	89	16	11	55	4	15	11	6·5 lb. seed extra, 1s. 5d.	4	14	6
3 ,, 32 ,,	85	23	8	6	3	4	10	1·6 lb. seed extra, 4d. ...	3	4	6
3 ,, 40 ,,	77	17	......		......			....	......		

Improved Yellow Dent Experiment.—The site selected was portion of an old lucerne field. The lucerne was ploughed out early in August with a single-furrow disc plough, and harrowed down with heavy harrows. The land was again ploughed in September to a depth of 10 inches, then rolled and harrowed, ploughed again in October, and cultivated with a disc cultivator. All the lucerne was by this time eradicated, and the land was in excellent condition. Planting operations were carried out on 13th December. The maize was sown with a maize-dropper in rows 4½ feet apart. No fertiliser was used. Plots were sown at the following rates of seeding :—

Distance apart.	Grains per Acre	lb. per Acre.
3 grains every 40 inches... ...	8,712	8
3 ,, 32 ,, ...	10,890	10
3 ,, 28 ,, ...	12,446	11½
3 ,, 20 ,, ...	16,924	16

There are 1,110 grains of Improved Yellow Dent to the lb. The land had been well prepared, and was in excellent condition. Useful rains were received prior to planting, and the germination was very satisfactory throughout the experiment. Cultivation was commenced early in January ; the rows were hilled with a disc hiller on 27th January. Two cultivations were given after hilling, and the crop presented a very clean appearance. The rainfall (2,147 points) was very satisfactory, and splendid growth was made on all the plots. The crop was harvested on 2nd July.

Treatment.	Yield per Acre.		Increase due to treatment.		Value of Increase.			Cost of Increase.	Net Gain.		
	bus.	lb.	bus.	lb.	£	s.	d.		£	s.	d.
3 grains every 20 inches	74	24	8	19	3	6	8	8 lb. seed extra, 1s. 8d....	3	5	0
3 ,, 28 ,,	71	30	5	25	2	3	7	3½ lb. seed extra, 9d. ...	2	2	10
3 ,, 32 ,,	69	8	3	3	1	4	5	2 lb. seed extra, 5d. ...	1	4	0
3 ,, 40 ,,	66	5	......		......			....	......		

In both the Leaming and the Improved Yellow Dent experiments the lowest rate of seeding gave the lowest yield. In the Dent the highest net gain per acre was obtained from the heaviest seeding—that is, 16 lb of seed per acre. In the Leaming, the highest net gain was obtained from the second heaviest seeding, namely, 9·3 lb. per acre.

Farmers' Experiment Plots.

Potato Experiments, 1919–20.

Cotta Walla—Crookwell District.

R. N. MAKIN, Inspector of Agriculture.

THROUGH the enterprise of the Cotta Walla branch of the Agricultural Bureau, potato plots were last year established on the farms of the following three members :—

Plumb and Wray.
Howard Bros.
Geo. Butt.

At the present time much attention is being given to procuring varieties of some merit, as many of those extensively grown before the appearance of Irish blight have become almost a thing of the past, and many of the newer varieties have proved disappointing.

It is not to be expected that a variety will be found that will keep its character year after year without proper attention to seed selection ; and, further, in order to increase our average acre yield and produce better quality potatoes, more attention must be given to selecting seed from high-yielding plants in the paddock. Not only should those yielding well be selected, but also those showing character and resistance to disease.

The tests under review were all conducted on basalt country, typical of the older potato-growing soils of the Crookwell district. Mr. Butt's land had not been under the crop for some time, while Messrs. Plumb and Wray's ground was under the crop last year, and Messrs. Howard Bros. the year before.

The soil is of red colour, rather loose when well worked up, but inclined to set in dry weather. It is a soil that could largely be improved by the addition of vegetable matter, such as red clover, field peas, rye, rape, or some such green matter ploughed under before or at the time of planting. All plots were manured with superphosphate at the rate of 3 cwt. per acre, distributed along the rows at the time of planting.

The seed was chiefly secured in the district, and was sown at the rate of about 12 cwt. per acre, the sets being dropped by hand at about 20 inches in the rows and about 30 inches between the rows, at a depth from 4 to 6 inches. All plots were sown during November.

The weather conditions were good until the end of January, when a dry spell set in, but later good rain fell, and the result was the best average yields since experiments have been conducted in the district. The potato moth

grub accounted for a good many of some of the largest sized tubers, and decreased the yield in several cases. This pest is always more troublesome during dry weather spells; deeper ploughing generally serves as a preventive.

The outstanding feature of the past season's experiments is the fact that Factor, a potato comparatively new to the district and fast coming into favor, topped the yields on each experiment plot. It is a white-skinned potato of fairly even growth, and generally of good cooking quality. With careful selection of the seed the Crookwell growers should find this potato a very fine market variety.

Earl Manistee is likely to be largely grown as an early variety. It has much to recommend it, the table quality being of the best. It is a light pink-skinned variety; although not reckoned a high yielder, it can generally be depended upon under good cultivation to yield potatoes of very fine size, showing all the desirable points of good table potatoes.

POTATO Variety Trials.

Variety.	Plumb and Wray, Cotta Walla.				Howard Bros., Cotta Walla.				Geo. Butt, Cotta Walla.			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
Early Manistee	3	15	2	24	4	0	3	8	5	3	1	24
Carman No. 1	4	13	0	21	3	19	3	3	5	7	3	21
Satisfaction...	4	0	2	4	2	19	0	16	4	15	0	13
Up-to-date	4	7	3	12	3	11	1	17	4	14	0	23
Magnum Bonum	5	14	0	12	2	12	2	25	4	2	1	9
Factor	5	17	0	16	5	4	3	14	6	0	0	11
Coronation	3	19	0	2	3	6	0	2	3	15	2	9
Brownell's Beauty	....				3	15	2	16	4	13	0	20
Dalhousie	5	0	2	4	....				....			
Langworthy	3	16	2	14	....				....			
Victorian Carman	3	15	2	25	....				....			

A potato largely grown in the district is the old Magnum Bonum, known locally as "Old Whites." It is a white-skinned, very late-maturing potato, and highly resistant to most of the fungoid troubles, but it is showing signs of "running out," and growers are advised to use up-to-date methods of seed selection to prevent the loss of such a fine variety.

Up-to-date, another white-skinned variety, does very well in some parts of the district. Indeed, some farmers consider it the best.

Coronation, a mottled-skinned variety, has been very disappointing. In many cases germination has been poor, and an unusually large percentage of second growth appears in some crops, so it is not altogether recommended for growing in any quantity.

Satisfaction is too well known for any comment.

Carman No. 1, of which there were local and Victorian strains, is perhaps, likely in the future to be largely grown, and may possibly take the place of Up-to-date, as it does not, as a rule, run to second growth so much.

Dalhousie and Langworthy are two white-skinned varieties still in the experimental stage, there not being sufficient seed yet for any large areas.

The Brownell's Beauty under test was not altogether the old type, it now being a difficult matter to obtain seed of the original type.

In selecting varieties of potatoes suitable for the Crookwell district, one could safely mention Magnum Bonum, Factor, Early Manistee, and Carman No. 1, or Up-to-date. In all cases early preparation of the ground, artificial and green manuring, and, if possible, a rotation of crops will all help towards improvement in the potato crops.

INSECTS ATTACKING NUT KERNELS.

The species of insects most commonly met with in nut kernels such as almonds, peanuts, Barcelonas, walnuts, &c., are :—

1. Indian Meal Moth (*Plodia interpunctella*).
2. Rust Red Flour Beetle (*Tribolium ferrugineum*).
3. Saw-toothed Grain Beetle (*Silvanus surinamensis*).
4. The Cadelle Beetle (*Trogosita mauritanicus*).

The life history in all four species consists of four stages, namely, egg, larva or grub, pupa or chrysalis, and adult insect. The grubs on hatching from the eggs feed on the kernels, and when full grown transform to the pupal condition, from which they emerge as the adult insect.

All the damage done by the first-named of these four insects, and the greater part of that by the others is done during the grub stages of the insects. Shelled kernels, on account of their direct exposure to infestation, are always much more heavily infested than unshelled. In the former the adult insects usually lay their eggs directly on the kernels, but in the latter the eggs are laid externally on the shells, usually in the vicinity of the natural division between the two halves of the shells. Infestation most often occurs in storage, usually in the country of origin, but it may also occur by contact with other infested foodstuffs during transit.

Some varieties are more liable to attack than others, no doubt in accord with climatic and other conditions under which they are grown. Varieties with hard, thick, strongly and closely sealed shells are naturally less liable to attack than thin shelled and imperfectly sealed ones. Shelled kernels are always liable to heavy infestation.—T. MCCARTHY, Assistant Entomologist.

WHAT HERD IMPROVEMENT MIGHT DO.

MANY cows in Victoria yield 450 lb. of butter annually, while the average is only 175 lb. There are, unfortunately, very many cows producing less than 100 lb. per year. It would be quite an easy matter to increase the average yield to 250 lb. per cow by improved breeding and feeding. If this were done, the butter production of Victoria would be increased by 40,000,000 lb., having a value of nearly £5,000,000. The breeding of cows can be improved by using only pure-bred sires from profitable dairy stock, and every effort should be made to grow and conserve fodder so as to prolong the period of lactation and thus raise the average production as indicated.—R. CROWE, Export Superintendent, Victoria.

Varieties of Wheat Tested in New South Wales.

J. T. PRIDHAM, Plant Breeder.

THE accompanying list of varieties of wheat has been prepared in the hope that it will be of use to growers who are interested in the testing, in this State, of the many wheats grown in the different parts of the world. The table serves to show the great number of varieties that have been tried by the Department, and also in a measure the large amount of crossbreeding and selection that has been done. Seed of many of the varieties named is quite unprocurable, the Department having only grown them long enough to determine their possible utility for our purposes, but the record will serve, perhaps, to answer the questions that arise from time to time about little-known varieties.

The information in the column "districts for which suitable" is based on observations at the Department's experiment farms, and on reports from farmers. Some growers, perhaps, will not agree with the classification in regard to season of maturity, but the terms "early, midseason, and late" are used relatively to the chief wheat-growing area of the State. A wheat marked "E" (early), may be very early, and this is more or less indicated by the district where it is likely to thrive, as, for instance, "hot and dry;" or, a variety may be styled late, and if recommended for "cold districts only" it may be concluded that it will be very late when grown there.

Care and discrimination are necessary in the choice of varieties for any locality, and introduced kinds should be tried on small areas only. A variety is sometimes saddled with a defect that would not have appeared if the grain had been sown at the proper time. An early wheat, for instance, if sown too early, is sometimes blamed for becoming frosted, and a long season, late variety, if not given sufficient time to produce a crop, may be branded as unproductive.

Caution.—It should be understood that the list does not in any way recommend the varieties named. It merely gives general information for the benefit of farmers. For convenience, however, the names of those varieties that are recommended by the Department for various purposes are printed in black type.

Key.

SEASON.
- E = Early, to be sown late.
- M = Midseason, to be sown midseason.
- L = Late, to be sown early.

USE.
- H = Adapted for hay.
- G = ,, grain.
- HG = General purpose.
- F = Fodder — ensilage or green fodder.

CLASS.
- S = Soft or weak flour grain.
- M = Medium soft flour grain.
- H = Hard or strong flour grain.
- P = Grain suitable for pigs and poultry.
- D = Durum or macaroni grain.

VARIETIES of Wheat grown or tried in New South Wales, with short descriptive notes.

Variety.	Season.	Use.	Class.	Origin.	Districts for which suitable.	Defects.	Distinguishing characters and good points.
Algerian	M-L	F	D	North Africa	Coastal	Bearded; sparse stooler	Rust resistant.
Allora Spring	E	HG	S	California	Dry and hot inland	Flour of inferior baking qualities.	Drought resistant; a brown ear with irregular tip beards, or very short awns to chaff.
Alpha	M	HG	S	West Australia (Steinwedel x King's Jubilee).	Main wheat belt	Rust liable	White, rather tapering ear.
Alpine	M	HG	S	Selection from Purple Straw	,, ,,	....	....
American 8	M	HG	S	America	,, ,,	Sometimes rather hard to thresh.	Brown; very tapering ear; tall straw.
American Prolific	...	...	...	= Steinwedel	,, ,,	....	....
Anvil	M	HG	S	South Australia (King's White x Roseworthy).	,, ,,	Shatters a little; straw medium strong.	White tapering ear; productive hay wheat.
Argentine	...	...	...	Like Barletta	....	....	....
Australian Poulard	M	F	P	Egypt	Dry and hot	Rust liable	Large heads and grain; beards tend to drop when ripe.
Australian Red Lammas	L	HG	S	....	New England	Rust liable; shatters somewhat.	Bald white tapering ears; red grain.
Australian Talavera	E	HG	S	Channel Islands	Central districts	Rather rust liable	White tapering ear; large white grain.
Avoca	M	HG	S	Mr. Lalor, Avoca, Victoria	Main wheat belt	,,	White tapering ear; productive hay wheat; tall straw.
Bald Medeah	...	...	...	= Huguenot	....	....	....
Barletta	M	HG	M	Russia	Central districts	Bearded, but awns not coarse	Ear medium size; straw slender; grain red.
Baroota Wonder	E	H	S	Telowie, South Australia	Main wheat belt	Rather rust liable	Resembles Zealand, but tip bearded and ripens earlier.
Basil	M	HG	S	South Australia, Roseworthy College (Fan x Red Fife).	,, ,,	Straw rather brittle	White tapering ear; grain pale red or brown.
Bayah	E-M	HG	S	Department's crossbred (Fife-Talavera-Jonathan).	,, ,,	Rather rust liable	Brown ear; resembles Federation.
Bearded Gluyas	E	HG	S	South Australia	,, ,,	Bearded; straw not very strong.	Light brown ear.
Belotürka	L	F	D	Russia	Coastal	Bearded	Rust resistant; scanty stooler; tall; practically solid straw; drought resistant.
Berrigan Champion	...	...	...	= Dart's Imperial	....	....	....
Berthoud's Crossbred 73	...	...	...	= Alpha	....	....	....
Billy Hughes	E	G	S	Mr. Rich, Wellington, Selection from Canberra.	Western	....	White bald ear.
Blount's Lambrigg	L	HG	M	American variety, Department's selection.	Tablelands	Shatters; rather late ripening	Small white shotty grain; white bald ear.
Blue Stem	...	...	...	= Haynes' Blue Stem, also = Dart's Imperial.	....	....	....
Bluey	...	...	...	= Dart's Imperial	....	....	....
Bobs	M	HG	H	Department's crossbred (Blount's Lambrigg x barley)	Tablelands	Tends to shatter; straw somewhat weak.	Small shotty grain; white ear more tapering than Blount's Lambrigg.
Bomen	M	HG	S	Department's crossbred (French-Fife-Indian).	Riverina	Susceptible to frost	White tapering ear; red grain; stiff straw.

VARIETIES of Wheat grown or tried—*continued*.

Variety.	Season.	Use.	Class.	Origin.	Districts for which suitable.	Defects.	Distinguishing characters and good points.
Boman	...	...	...	Corruption of Bomen	....	....	....
Budd's Early	M	HG	S	South Australia	Main wheat belt and North-west.	Rust liable	Brown ear; general purpose wheat.
Bunge	E	HG	S	Selection by Mr. Quodling of Queensland from Department's crossbred.	North-west	Medium strong straw ...	White, bald, tapering ear; stands feeding off.
Bunge No. 1	...	...	...	= Bunge	....	....	....
Bungowannah	...	...	...	= Ortlipp's Bungowannah ...	....	....	....
Bunyip	E	HG	M	Department's crossbred (Rymer x Maffra).	Main wheat belt ...	Brittle straw...	Bold, white, tip-bearded ear, large plump grain.
Burbank...	L	HG	S	America = Jones' Winter Fife	None	Too late ripening	Bald white heads; heavy stooler.
Californian Club ...	E	G	S	California	Main wheat belt ...	....	Short clubbed ear; does not shatter; straw short; stands up well.
Caliph	E–M	HG	S	South Australia, Roseworthy College = (Marshall's No. 3 x King's Red).	" " ...	Weak flour grain	White tapering ear; productive.
Canberra...	E	G	S	Department's crossbred (Federation x barley).	Main wheat belt, especially hot and dry.	Weak straw	Brown ear; very productive variety, even when sown late.
Carmichael's Eclipse ...	E	HG	S	Crystalbrook, South Australia	Main wheat belt ...	....	Brown ear, usually slightly felted; good for hay.
Cedar	E	G	H	Department's crossbred (Fife-Indian).	" " ...	Weak straw; only medium yield.	White ear; holds red-coloured grain well.
Chance Prolific	...	...	...	= Dart's Imperial	....	....	....
Chaff's Prolific... ...	...	...	...	" "	....	....	....
Chili	...	...	...	= Californian Club, sometimes = Warren.	....	....	....
Chul	E	G	M	Russia	Main wheat belt ...	Bearded; straw weak ...	Drought resistant; better for grain than hay; red grain.
Clarendon	E	HG	M–S	Department's crossbred (Bobs-Gluyas-Fife-Indian).	Hot dry districts and coast.	Straw medium strong when grown inland.	Bald white ear; rather sparse stooler; escapes rust.
Cleveland...	L	HG	M–S	Department's crossbred ...	Central tablelands and coast.	Liable to frosting in New England.	Rather rust resistant; large tapering white ear; tall straw.
Club Head	...	...	...	= Californian Club	....	....	....
College Eclipse	E	HG	S	South Australia, Selection from Carmichael's Eclipse.	Main wheat belt ...	....	Bald brown ear.
College Hunter	L	HG	S	New Zealand	None	Too late maturing	Heavy stooler.
College Purple	E	HG	S	Pye's crossbred, Victoria (Purple straw mostly).	Main wheat belt ...	Straw rather brittle when ripe.	White, tip-awned; clubbed ear; productive.
Comeback	E	HG	H	Department's crossbred (Fife-Indian).	" " ...	Medium yielder; straw rather slender.	White tapering ear; rather small white grain.
Commonwealth	M	G	S	Pye's crossbred, Victoria (Jubilee-Talavera-Federation)	" " ...	Too rust liable	Brown ear; short straw.
Coronation	M	HG	M–S	....	" " ...	....	Resembles Comeback, but grain softer.
Correll's No. 8	E–M	HG	S	West Australia (Medeah x Purple straw).	" " ...	Medium yielder	Ears white, speckled with black; holds grain well.
Cowra No. 15	M	G	M	Department's crossbred, complicated pedigree.	" " ...	Medium to good yielder ...	Dense white ear; short straw; well adapted for stripping.

VARIETIES of Wheat grown or tried—*continued.*

Variety.	Season.	Use.	Class.	Origin.	Districts for which suitable.	Defects.	Distinguishing characters and good points.
Cowra No. 19	E–M	G	S	Department's crossbred (Redskin x Yandilla).	Main wheat belt	Straw medium strong	White, rather clubbed ear; dense.
Cowra No. 24	E	G	H	Department's crossbred (Yandilla King x Indian).	" "	Straw rather weak...	Brown ear; strong tip-awn; short straw.
Cretan	L	F	D	South Europe or Russia	Coastal	Bearded; sparse stooler	Rust resistant; resembles Beloturka.
Crossbred 67	...	...	...	= Alpha	...	...	...
Cumberland	E–M	HG	S	Department's crossbred (same breeding as Comeback).	Main wheat belt	Rust liable, like Purple Straw.	White tip-bearded ear; Purple Straw type.
Currawa	M	HG	S	Pye's crossbred, Victoria (Northern Champion-Cretan-Club).	" "	Straw rather rotten when ripe.	White-clubbed ear; productive; straw rather short.
Dart's Imperial...	M	HG	S	Selection by Mr. Dart, South Australia.	" "	Rust liable; somewhat weak flour.	Drought resistant; does not shatter; tall strong straw; good general purpose wheat.
Dart's Improved	L	HG	S	Marshall's crossbred, South Australia (Jonathan x Dart's Imperial).	Riverina	Not so prolific as Marshall's No. 3.	Compact, white, bald ear; fairly good hay wheat.
Dawson's Golden Chaff	L	HG	S	America...	None ...	Too rust liable	Brown ear; slightly clubbed or full tipped.
Defiance ...	L	HG	M	America (Prof. Blount)	Tablelands	Rather too late maturing	Grain and ear resemble Blount's Lambrigg.
Dreadnought	L	G	S	England...	Only coldest districts	Too late maturing ...	Dense, broad, bald ear; red grain.
Droophead	E	HG	S	Erroneously Droophead Federation. A selection probably from Budd's Early.	North-west and Main wheat belt.	Grain yields a poor coloured flour.	Brown, nodding, tapering ear; productive.
Dumpty ...	L	HG	S	Apparently selection from Farmers' Friend.	Riverina	Matures too late	White, uniform, tip-awned, slightly tapering ear.
Durum ...	...	...	...	= Macaroni variety	...	...	...
Du Toits...	M	HG	S	South Africa	Main wheat belt	Weak straw; grain of poor quality.	White, tapering, tip-awned ear; rather small starchy grain.
Early Baart	E	HG	S	South Africa	" "	Straw rather weak ...	Hardy; white bearded ears; beards of unequal length; large grain.
Early Blue	...	...	...	= Droophead ...	...	...	...
Early Bud	...	...	...	= Budd's Early	...	...	...
Early Goldsmith	...	...	...	= Alpha	...	...	...
Early Haynes' Blue Stem.	M	H	S	Department's crossbred (Haynes' Blue Stem x Indian)	New England	...	White ear with slightly felted chaff; grain pale red.
Ecksteen...	E	G	S	South Africa	Main wheat belt	Straw weak ...	White bearded ear; productive; large white grain.
Eclipse ...	E	G	S	Dubbo district...	" "	Rather short for hay	Brown tapering ear; slightly felted chaff.
Egyptian...	...	...	...	= Mummy	...	...	...
Emmer ...	L	F	P	Central Europe...	Cold, poor soil	Too late for grain as a rule, and too hard to thresh.	Suited for grazing; heavy stooler with narrow foliage and slender straw.
Excelsior...	...	...	...	= Petatz' Surprise	...	...	...
Farmers' Friend	M	HG	S	One of the old Purple Straws...	Main wheat districts	Too rust liable	White, tip-awned, slightly nodding ear.
Farrer's Drought Resistant.	...	...	...	= Yandilla King	...	...	...

VARIETIES of Wheat grown or tried—*continued.*

Variety.	Season.	Use.	Class.	Origin.	Districts for which suitable.	Defects.	Distinguishing characters and good points.
Farrer's Durum	...	...	...	Similar to Beloturka	....	....	....
Federation	M	G	S	Department's crossbred (Fife-Indian-Purple Straw).	Main wheat districts	Liable to rust and diseases generally.	Brown ear; very productive; short straw.
Field Marshall	M	HG	S	One of Marshall's crossbreds, South Australia.	" " "	....	White, rather long, slightly tip-bearded, medium erect ear.
Fife	...	...	...	= Manitoba	....	....	....
Firbank	E	H	S	Department's crossbred (Zealand x Maffra).	Main wheat belt and Western Division.	Somewhat liable to loose smut.	Ears sharply tapering; white, lax and beardless.
Florence	E	HG	M	Department's crossbred (White Naples-Fife).	Dry inland and coastal.	Tends to shatter; straw medium strong.	White tapering ears; highly rust resistant.
Frame's Early	M	HG	S	Mount Barker, South Australia	....	....	....
Frampton	L	H	S	= Port MacDonnell, South Australia.	Riverina	Rather late ripening ...	Long tapering white ears.
Fretes	E	HG	S	Algeria	Main wheat belt ...	Bearded; weak straw ...	White, tip-bearded heads.
Fultz	L	HG	S	America...	None	Too late-ripening	Tip-bearded ear; heavy stooler; red grain.
Galland's Hybrid ...	L	H	P	France	None	"	Large bearded ears; hunch-backed large grain; beards deciduous.
Gamma	...	...	...	= Budd's Early, a selection from South Australia.	....	....	....
Genoa	L	HG	M	Same pedigree as Florence; Department's crossbred.	New England ...	Medium prolific	Similar in appearance to Florence, but much later ripening.
Giant Rye	...	...	...	= Polish wheat	....	....	....
Gluyas' Early	E	G	S	South Australia; probably originated from India.	Main wheat belt and hot, dry districts.	Rather apt to lodge ...	Brown ear; rather short slender straw; very productive; drought resistant.
Gold Drop	...	...	...	= Gluyas' Early	....	....	....
Golden Drop	E	H	S	South Australia	Main wheat belt and hot, dry districts.	Straw somewhat weak ...	White, fairly tapering, tip-awned ear; prolific.
Golden King	E	HG	S	South Australia	" " ...	Rust liable	Brown tip-bearded ear.
Gregson's	...	...	...	= Lotz...	....	....	....
Gresley	E	H	S	Mr. Grasby, West Australia (Federation x Huguenot).	Main wheat belt and hot, dry districts.	....	Long white tapering ear; tall straw.
Hard Federation ...	E	HG	M	Natural crossbred from Federation; Department's selection.	" " ...	Somewhat disease liable ...	Brown ear; rather less dense than Federation and straw slightly taller; good all-round wheat; stands feeding off.
Harriet	E	G	S-M	Mr. Farrell, Trundle-rd., Parkes (Comeback x Federation).	" " ...	....	Brown erect bald ear; rather short straw.
Haynes' Blue Stem ...	L	HG	S	America...	New England ...	Shatters readily; straw not very strong.	Tapering white-felted ears; tall straw; and red grain.
Hermitage	E	HG	S	Hermitage State Farm, Queensland.	" ...	....	White, bald, tapering ears.
Hudson's Early Purple Straw.	E-M	HG	S	One of the old Purple Straw group.	Main wheat belt ...	Rather rust liable; sometimes shatters.	White, uniform, tip-bearded ear; productive.
Huguenot	L	FH	D	Natural crossbred from Medeah; Mr. Correll, Arthur River, West Australia.	Coastal	Very sparse stooler; grain unsuitable for milling.	Bald heads; tall, practically solid straw; rust resistant; valued for hay by some, very palatable to stock.

VARIETIES of Wheat grown or tried—*continued.*

Variety.	Season.	Use.	Class.	Origin.	Districts for which suitable.	Defects.	Distinguishing characters and good points.
Hunter's White	L	HG	S	New Zealand	None	Too late maturing	White ear, tapering; red grain.
Huron	L	HG	S	Canada (Ladoga x Fife)	Cooler districts	Bearded; late ripening	Pale-brown ears; tall straw; stools well.
Imperial	...	...	...	= Dart's Imperial	...	...	...
Improved Steinwedel	E–M	H	S	Pye's crossbred (Steinwedel-Purple Straw).	Main wheat belt	Tends to shatter somewhat; rust liable.	Resembles Steinwedel, but the spikelets are not quite so widely spread.
Indian Blue	M	HG	S	South Australia = Indian Red	...	...	Brown ear; like Budd's Early, but chaff shorter.
Indian Red	...	...	...	= Indian Blue	...	...	...
Indian Runner	...	...	...	= Medeah	...	...	...
Jade	E–M	HG	S	Department's crossbred (Purple Straw x Early Baart).	Main wheat belt	Weak straw; rust liable	Large white, tip-bearded ears; grain large, white; productive.
John Brown	M	H	M	Department's crossbred (Fife-Talavera and others).	Coastal	Medium productive for grain	Brown tapering ears; tall straw; large grain with deep crease.
Jonathan	M	HG	H	Department's crossbred (Fife-Indian).	Tablelands	Medium yielder; hard to thresh.	White bald ears; small shotty grain.
Jubilee	M	HG	S	Victoria	Main wheat belt	...	White tapering ears; tall straw.
Jumbuck	M	HG	S	Department's crossbred (Fife-Tardent's Blue-Talavera).	" "	Rust liable; tends to shatter	White felted ears; large grain.
Kanred	L	HG	H	Selection from Russian; received from U.S. America.	?	Too late maturing; bearded	Grain red; medium to small size; fairly long.
Kharkov	L	HG	H	Russia. Also spelt Karkof; Karkov, Turkey.	?	Too late; bearded	Slender straw; grain red, medium to small.
King's Early	E	HG	S	South Africa; selection from Early Baart.	Main wheat belt	Bearded; straw rather weak	Semi-solid straw; productive; does not shatter.
King's Red	...	...	...	Selection (South Australia) from King's Early.	" "	" "	Like King's Early except that grain is red.
King's White or King's Early White.	...	...	...	" "	" "	" "	Resembles King's Early.
Kitchener	L	HG	H	Canada; selection from Marquis.	Cold districts	...	Bald tapering ear; grain like Marquis.
Knockout	...	...	...	= Dart's Imperial	...	...	...
Kubanka	L	GF	D	Russia	Coast for fodder; Main wheat belt for grain.	Bearded; sparse stooler	Makes the best bread in the world if grain is well-conditioned in mill.
Leatherhead	L	HG	S	South Australia; Farmers' selection.	Main wheat belt	Rather rust liable	White tapering ear; tall white straw.
Le Huguenot	...	...	...	= Huguenot	...	...	...
Limberg's Velvet	...	...	...	= Tardent's Blue	...	...	...
Lott's or Lotz	M	HG	S	West Australia: = Gregson's	Main wheat belt	Rather rust liable	Closely resembles Dart's Imperial.
Majestic	M	HG	S	South Australia: Marshall's crossbred.	" "	...	Tapering. white ear; dark yellow grain.
Major	L	HG	S	Pye's crossbred (Federation x Wallace).	North-west and Riverina.	Somewhat rust liable	White heads; medium length with broad tip; straw strong and stout.
Mammoth Rye	...	...	...	= Polish	...	...	...
Manitoba	L	HG	H	Galicia, Central Europe. General name for Fife group.	Coldest districts	Straw rather apt to lodge; tends to shatter.	Tapering white, bald ears; small shotty grain, usually red.

VARIETIES of Wheat grown or tried—*continued.*

Variety.	Season.	Use.	Class.	Origin.	Districts for which suitable.	Defects.	Distinguishing characters and good points.
Marquis	L	HG	H	Canada (Fife-Indian)	Coldest districts	Straw slender	Heads and grain like Manitoba, but rather earlier and holds grain better.
Marshall's No. 3	M	HG	S	South Australia; Marshall's crossbred.	Main wheat belt	....	Not rust liable; serviceable general purpose variety.
Marshall's Prolific	M	HG	S	" "	" "	....	Nodding, white, slightly tip-bearded ear.
Marvel	...	...	...	= Red Marvel...	....	....	....
Marster's Perfection	...	...	...	= Perfection ...	....	....	....
Medeah	L	F	D	North Africa	Coastal	Strong beards; sparse stooler	Smut, rust, and drought resistant; like macaroni wheats generally.
Minister	M	HG	M	Pye's crossbred (Dart's Imperial-Fife-Indian).	Main wheat belt	....	White clubbed ear; straw rather short.
Moira	M	HG	S	Pye's crossbred (Purple Straw-Fife-Indian).	" "	Somewhat rust liable	Ear clubbed at tip; typical Purple Straw variety.
Mountain Blue	...	...	...	= Dart's Imperial	....	....	....
Mummy	L	F	P	Europe; also known as Egyptian, Alaska, Branched, Miracle.	Main wheat belt	Not suited for bread-making	Ear often has branched spikelets; large hunchbacked grain.
Nash's	E–M	HG	S	Farmers' selection from Parkes district = Velvet Top.	" "	....	White, felted, bald, nodding ear.
New England Champion	L	HG	S	Tamworth district	North-west	Rather too late	Long, tapering, white, tip-bearded ear.
Newman's Early	E	HG	S	South Australia; farmers' selection.	Riverina	....	Rather large, tapering white, tip-bearded ear; large yellow grain.
New Zealand Velvet	E–M	HG	S	Tamworth district	North-west	Foliage rather pale-green for hay.	Felted, white, bald ears.
Nobby	...	...	...	= Californian Club	....	....	....
Nonpariel	M–L	H	S	South Australia	Cooler districts	....	Slender, white, tapering ears; straw tall, not coarse.
Odessa	L	H	S	South Australia	"	Rust liable; flaggy...	Tapering, white, thin ears; tall straw.
Oregon	...	...	...	= Californian Club.	....	....	....
Ortlipp's Bungowannah	L	H	S	Albury district; farmers' selection by Mr. Ortlipp.	Riverina	Straw purple...	White, long, tapering, tip-bearded heads; tall straw.
Penguin Island	...	...	...	= Gluyas Early	....	....	....
Penny	M	HG	S	Victoria; farmers' selection	Main wheat belt	Somewhat rust liable	Typical Dart's Imperial ear; good hay wheat.
Pennyroyal	E–M	HG	S	Wagga; farmers' selection	Riverina	....	Rather like Dart's Imperial.
Penny's Squarehead	...	...	...	= Dart's Imperial	....	....	....
Perfection	L	F	P	Europe; = Marster's Perfection.	Main wheat belt	Too late maturing; bearded	Beards drop off mostly when ripe; large humpbacked grain; tall straw.
Petatz' Surprise	E	HG	S	South Australia; farmers' selection.	" "	Straw somewhat weak	White, tapering ear; remarkable for high bushel weight of grain.
Phillis' Marvel	M	HG	S	South Australia; related to Ward's Prolific.	" "	....	Long ear; large grain; good for hay.
Pioneer	E	HG	M	... ? ...	Hot dry districts	Medium yielder	White, tip-bearded, tapering ear.
Pioneer Purple	...	...	...	= Smart's Early	....	....	....
Plover	M	HG	S	Department's crossbred (Yeoman x Purple Straw).	Main wheat belt	Somewhat rust liable	Large, white, tapering ears; tall stout straw; general purpose wheat.
Plowman's No. 3	E	HG	S	Selection by Mr. Plowman, Goonumbla.	Hot dry districts	....	Dark brown ears; stout tall straw; good early hay.

VARIETIES of Wheat grown or tried—*continued.*

Variety.	Season.	Use.	Class.	Origin.	Districts for which suitable.	Defects.	Distinguishing characters and good points.
Polish	M	F	H	Europe; = Mammoth Rye	Main wheat belt	Sparse stooler; unsuitable for bread.	Very large loose ears; solid straw; extremely large grain.
Port MacDonnell	...	...	...	= Frampton	...	...	...
Power's Fife	...	...	...	= Manitoba	...	...	...
Prelude	E	G	M–S	Canada (Indian crossbred)	Main wheat belt	Bearded; short, rather weak straw.	White, rather small ear; red grain.
Pride of the West	...	...	...	Quirindi; resembles Blount's Lambrigg	...	...	...
Propo	M	HG	S	California	Main wheat belt	Bearded; rust liable	White tapering ear; large grain.
Pugh's Rust Resistant	...	...	...	= Allora Spring	...	...	...
Purple Straw	M	HG	S	Probably from England	Main wheat belt	Rather rust liable	Slightly clubbed-tip to ear (not always); grain yellow and of good size.
Purple Straw Tuscan	M	HG	S	... ? ...	,, ,,	...	White, tip-bearded, tapering ear; tall, purple straw.
Pusa	E	G	M–H	Indian Department of Agriculture; a number of varieties issued under numbers.	Main wheat and hot dry districts.	Weak straw as a rule	Ears often bearded; hold their grain, which is hard; straw slender and short.
Queen Fan	M	HG	S	South Australia (Fan x Carmichael's Eclipse).	Main wheat belt	...	White, uniform, tip-bearded ear, with spreading spikelets and stout straw.
Queen's Jubilee	E	HG	S	Victoria	,, ,,	Rust liable	Large, white, tip-bearded, tapering ear.
Rattling Jack	M	HG	S	One of Purple Straw group	,, ,,	More rust liable than the average Purple Straw.	Dense clubbed ear; straw rather short and stout; grain yellow.
Rattling Tom	...	...	...	Similar to Rattling Jack	...	...	...
Red Bobs	L	HG	H	Canada; natural crossbred from crop of Bobs.	Cool districts	Tends to shatter; straw medium strong.	Resembles Bobs when growing; but grain is red.
Red Fife	...	...	...	= Manitoba	...	...	...
Red Glyndon	...	...	...	,,	...	...	...
Red Lammas	L	HG	S	New England	North-west	Shatters somewhat	Nodding, white, tapering ear; red grain.
Red Marvel	L	HG	S	England	None	Too late maturing	Dense broad ear; stout straw; red grain.
Red Rock	L	HG	M	U.S. America	,,	Too late; bearded	Tapering white ears; red grain.
Red Russian	L	HG	S	Marshall's crossbred (Russian x Australian variety).	Main wheat belt—cooler parts.	Rather late ripening	Pale brown bald heads; red grain.
Red Straw	M	HG	S	One of Purple Straw group	Main wheat belt	Rust liable	Straw not quite so coarse as Purple Straw and therefore, better for hay.
Red Tuscan	M-L	H	S	...	,, ,,	...	Tip-bearded, white, tapering ears; red grain.
Red Wing	E	G	M	Wellington; selection by Mr. Rich, from Canberra.	,, ,,	Straw rather brittle	Brown bald ear; white grain.
Rieti	L	HG	S	Italy	Coastal	Slightly bearded; rather too late.	Very rust resistant; large grain.
Roseworthy	M	HG	S	Roseworthy College, South Australia.	Main wheat belt	...	Resembles Marshall's No. 3, but straw not purple; and grain more plump.
Ruby	M	HG	H	Canada (Fife-Indian)	... ? ...	Straw rather weak	Bald ears; red grain.
Rymer	M-L	HG	S	Department's crossbred (Fife-Purple Straw).	Main wheat belt	Straw inclined to be weak	White, tapering, ears; straw white, slender.
Sailor's Fortune	...	...	...	= Droophead	...	...	...
Sailor's Wonder	...	...	...	Apparently = Droophead	...	...	...

VARIETIES of Wheat grown or tried—*continued.*

Variety	Season.	Use.	Class.	Origin.	Districts for which suitable.	Defects.	Distinguishing characters and good points.
Salter's Hard Federation	...	...	...	Mr. E. E. Salter, Wellington; selected strain.	....	....	....
Sanger's Prolific ...	M	HG	S	Selection by Mr. Sanger, of Wendouree, Coolamon.	Main wheat belt ...	....	Resembles Dart's Imperial closely.
Scaddan's Glory ...	...	...	...	= Baroota Wonder	....	....	....
Schmidt's No. 1 ...	M	G	S	Selection by Mr. Schmidt, of Walla Walla.	Main wheat belt ...	Rust liable	Brown clubbed ear; a variation from Federation.
Schneider	E-M	HG	S	Department's crossbred (½ Purple Straw).	" " ...	Rust liable; tends to shatter	Drought resistant; ears rather like Steinwedel.
Schultz	M	HG	S	Mr. Schultz, Henty	" " ...	....	Rather tapering, white, tip-bearded ears; perhaps better for hay than grain.
Schultz' Purple Straw ..	M	HG	S	Mr. Schultz, Sheep Hills, Victoria.	" " ...	Somewhat rust liable ...	Ear white, nodding, tip-bearded, fairly compact.
Sensation or Sutton's Sensation.	L	HG	M	France and England	Cold districts only ...	Usually ripens too late ...	Ear resembles Cleveland, but the grain is red.
Sheriff's Squarehead ...	...	...	...	= Lotz...	....	....	....
Silver Baart	E	HG	S	South Africa	Main wheat belt ...	Straw not very strong ...	White, slightly nodding, tip-bearded ears; does not shatter; not rust liable.
Silver King	M	HG	S	Selection from Marshall's No. 3	" " ...	....	Resembles Marshall's No. 3, but straw is not purple.
Silver Star	...	...	...	Albury district...	....	....	....
Smart's Early	M	HG	S	....	Main wheat belt ...	Flaggy hay wheat, somewhat rust liable.	White, tip-bearded, uniform ear; strong purple straw.
Smut Proof	...	...	...	= Florence in South Australia.	....	....	....
Sonora	E-M	HG	S	California	Main wheat belt ...	Pale green foliage, not prime for hay.	Brown, felted, bald ears.
Spelt	L	F	S	Cold poor soils of Europe ...	Coldest districts ...	Very hard to thresh, rust liable.	Bearded, very slender tapering ears, sometimes bald; only suitable for grazing or soiling.
Squarehead	...	...	...	= Dart's Imperial	....	....	....
Steinwedel	E	H	S	South Australia; farmers' selection.	Main wheat belt ...	Shatters badly; quite rust liable.	Large, full, white, tip-bearded ears; heavy yielder.
Stockton Defiance ...	...	...	...	Closely resembles Early Baart	....	....	....
Sullivan's Early Prolific	...	...	...	= Steinwedel	....	....	....
Sunset	E	HG	S	Department's crossbred (Blount's Lambrigg-Fife-Club).	Hot dry districts ...	Sparse stooler	Drought escaping; earliest wheat grown; white, tapering, bald ear.
Sussex	L	H	S	Department's crossbred (Fife Essex x Tuscan Essex).	Coolsouthern districts	Somewhat rust liable ...	Long, tapering, white ear; tall straw.
Sutton's Special Mixture	...	...	...	= Baroota Wonder	....	....	....
Suttor's Prolific... ...	...	...	...	= Dart's Imperial	....	....	....
Tardent's Blue ...	L	H	S	Mr. Tardent of Queensland, who got it from South Russia.	Central Tablelands ...	....	Felted, white, bald ear; tall straw.
Tarragon...	L	HG	S	Department's crossbred (Fife x Tardent's Blue).	" ...	Straw medium stout ...	Tapering, white, tip-bearded ear; same season as Cleveland.
Teakle's Red	M	HG	S	Mr. Teakle, Isseka, West Australia.	Riverina	....	Rather nodding, brown, tip-bearded ear; stems better for hay than grain.

VARIETIES of Wheat grown or tried—*continued.*

Variety.	Season.	Use.	Class.	Origin.	Districts for which suitable.	Defects.	Distinguishing characters and good points.
Thew	E	HG	S	Department's crossbred (complicated pedigree).	Coastal	Straw rather slender ...	Ear resembles Comeback; rust escaping.
Tiger	M	HG	S	Goonumbla,; farmers' selection.	Main wheat belt ...	Too rust liable	Tip-bearded, slightly clubbed ear.
Town and Country ...	...	...	...	= Blount's Lambrigg ...	....	....	....
Triumph...	E–M	HG	S	Marshall's crossbred (Silver King x Ranjit).	Main wheat belt ...	Straw sometimes brittle ...	Rather nodding tip-bearded, white ear, tall straw; good for hay.
Turkey or Turkey Red...	...	...	...	= Kharkov.	....	....	....
Turvey	M	HG	S	Victoria; sometimes Turvey's Purple Straw.	Main wheat belt ...	Straw brittle when ripe and lodges sometimes.	Nodding, tip-bearded, white ear; better for hay than grain.
Velvet Top	...	...	...	= Nash's	....	....	....
Viking or Early Viking...	...	...	...	Resembles Gluyas; farmer's selection from South Australia.	....	....	....
Walker's Wonder ...	...	...	...	= Droophead	....	....	....
Wallace	M	HG	S	Pye's crossbred (Fife-Indian-Purple Straw).	Main wheat belt ...	Rather rust liable	Large clubbed-tip ear, white, tip-bearded; straw shorter than College Purple.
Walmer	E	HG	S	Mr. Farrell of Parkes (Federation x Steinwedel).	,, ,, ...	,, ,, ...	Brown, uniform, tip-bearded ear; does not shatter.
Warden	M	H	S	Pye's crossbred (Cross on Ward's White.	,, ,, ...	....	White, tapering, bald ears; red grain; tall, good quality straw; prime for hay.
Ward's Prolific... ...	M	HG	S	Mr. Ward's selection, Nelsbaby, South Australia.	,, ,, ...	Grain yields a flour of poor quality.	Brown, bald, tapering ears; fairly rust resistant.
Warren	E–M	HG	S	Department's crossbred (Warner x Bobs x Jonathan).	Coastal and Central West.	Straw not very strong ...	White, bald, tapering ear; rust resistant.
Western Wonder ...	...	...	...	= Lotz...	....	....	....
White Essex	...	...	...	Resembles White Lammas ...	....	....	....
White Hogan	...	...	...	,, ,, ...	....	....	....
White Lammas... ...	L	H	S	England...	New England, Central and Southern Tablelands.	Rather rust liable and lodges on rich soils.	Tapering, white, bald ear; large white grain; tall straw, good for hay.
White Tuscan	M	HG	S	....	Main wheat belt ...	Rather leafy...	White tip-bearded ear: rather tall straw: a very fair hay wheat.
White Velvet	M	HG	S	Probably California	,, ,, ...	Pale green foliage, not very suitable for hay.	Bald, white, felted ears.
Wilfred	E	HG	S–M	Mr. Grasby, West Australia (Alpha x Federation).	,, ,, ...	Rather less productive than Hard Federation.	Like Hard Federation, but slightly less rust liable; blunt tip to ear.
Wilkinson's Early Prolific.	...	...	...	= Gluyas' Early	....	....	....
World's Champion ...	...	...	...	= Lotz...	....	....	....
World's Wonder ...	E–M	HG	S	....	Main wheat belt ...	....	Ear rather like Dart's Imperial; straw stout, medium height.
Yandilla	E	G	S M	Department's crossbred (Fife-Indian).	Dry, hot districts ..	Short straw for hay... ...	Ears white, bald, medium size, clubbed tip.
Yandilla King	M	HG	S	Marshall's crossbred (Yandilla x Silver King).	Main wheat belt ...	....	Like Marshall's No. 3 in the field; straw rather shorter and not purple.
Zealand	L	H	S	France	Riverina	....	Long white, bald, tapering ears; tall straw, large white grain.

Decline in British Sheep-breeding.

At the international conference held at Darlington, England, by the (British) National Sheep-breeders' Association on 28th June, a paper read by Sir Henry Rew dealt with the subject of the decline in British sheep-breeding, in respect to which he gave statistical facts, and discussed certain economic tendencies. Concerning the reduction in the number of sheep in Great Britain, Sir Henry pointed out that the official agricultural returns (collected annually in June) are the only source of information, but they show the number over a period of fifty years. This period he divided into quinquennial sections, and the total stock of sheep in each such five-yearly period he found to be:—

Period.	Number of Sheep.	Period.	Number of Sheep.
1870–1874 ...	28,600,000	1895–1899 ...	26,000,000
1875–1879 ...	28,400,000	1900–1904 ...	25,900,000
1880–1884 ...	25,300,000	1905–1909 ...	26,300,000
1885–1889 ...	25,800,000	1910–1914 ...	25,400,000
1890–1894 ...	27,600,000	1915–1919 ...	23,700,000

From the above, leaving out the war period, it appears that "after the disasters of the early eighties the flocks of the country never recovered the position they held in the seventies," and "that during the present century they have fallen substantially below the standard of the nineties." Sir Henry referred to a disturbing element in connection with these comparisons, namely, the age at which sheep are now slaughtered: "Four-year-old wether, which used to represent the highest standard of mutton production, is now seldom seen at table. Early maturity has been adopted as a principle. It is evident that with the progressive adoption of this principle the number of sheep each year would decrease, even though the actual number bred were maintained."

Sir Henry Rew concluded: "If the importance of extending the arable area and increasing the production of cereals is recognised by the nation, it must also be recognised that one of the means which will assist in securing that end is to ensure that confidence is restored to the sheep-breeding interest, which has for generations been in a large degree the mainstay of British agriculture."

Lucerne as a Foodstuff.

Green lucerne is not only relished by horses, cattle, sheep, and swine, but it is specially adapted to their needs. When fed freely to young animals it promotes a large and vigorous growth. Along with suitable grain adjuncts, it will fatten animals quickly, and will give them a fine finish. With but a limited addition of carbonaceous food, swine may be raised upon it until ready for the block. Of course, during the fattening period, grain must be the chief reliance. But to no class of stockman is green lucerne of more benefit than to dairymen. It is excellent for milk production, and the long season during which it is accessible further accentuates its value.

Of course, in the green form, it should be fed with some restriction to horses at work, but for all other classes of horses it makes excellent food. It is also helpful when fed to fowls. Other things being equal, meat and milk cannot be produced anywhere more cheaply than in areas possessed of high adaptation for growing lucerne.—*South African Dairyman.*

"Khapra," an Indian Wheat Pest.

W. W. FROGGATT, F.L.S., Government Entomologist.

STATEMENTS have lately been made about the presence of the Indian insect pest "khapra" in New South Wales, and have been so widely reported that it seems advisable to place on record a few notes on the subject.

It has been said (1) that the Indian dermestid beetle, called the "khapra," has been found in wheat in Sydney, and (2) that Professor Lefroy in January, 1918, said he had discovered a worse pest than grain weevil in Australian wheat, and this was the khapra. The pest was found in the wheat stacked at Enfield.

As regards the first statement, it has to be said the insect that was seen in the samples of wheat at the Chemist's Branch of the Department of Agriculture was not the khapra, but that cosmopolitan grain beetle (also a native of India) which American entomologists have named the lesser grain borer (*Rhizopertha dominca*). This beetle was found in large numbers in the wheat stacked at Enfield in 1918, and was identified, figured, and described in the pages of the *Agricultural Gazette* in 1918. The writer, with Mr. T. McCarthy, and later on with Mr. A. M. Lea, of the Adelaide Museum, made a very careful biological survey of the wheat stacks at White Bay and Enfield, collecting and mounting every species of insect that was found infesting wheat. As a member of the Imperial Wheat Diseases Committee, the writer visited many of the stacks in different parts of the State, and also all those in the vicinity of Melbourne. No specimen of this Indian wheat pest was found in any of our stacks.

It is somewhat remarkable that Professor Lefroy, if he found this beetle in Sydney, did not announce his discovery, or at least notify Australian entomologists that they had another wheat pest to study and fight. No record can be found of Professor Lefroy having made such a discovery public. When working on the wheat pests three years ago, I obtained authentically named collections of stored grain pests from the Federal Bureau of Entomology at Washington, U.S.A., Mr. J. J. Walker, Oxford University Museum, England, and from the Entomological Department of the Imperial Department of Agriculture, Pusa, India. The only specimens of the khapra were those in the collection sent from India by Dr. Bainbridge Fletcher.

This beetle belongs to the family *Dermestidæ*, which includes a number of well-known pests in stored foods, such as the skin weevil (*Dermestes vulpinus*) and the bacon weevil (*Dermestes lardarius*).

In the earlier Indian reports the khapra was known under the name of *Æthriostoma undulata*; then it was placed in the genus *Attagenus* and became *Attagenus undulatus*. Later investigators concluded that its

proper place was in the genus *Trogoderma,* and decided that it was not even *undulatus,* so the specific name was dropped, and the popular name of khapra was attached to it; hence its scientific name as it now stands is *Trogoderma khapra.*

This beetle was first noted as a pest in India by Coates in *Indian Museum Notes* (vol. ii, 1893, p. 148) as *Æthriostoma undulata* Motsch. "A little brown beetle, with white, hairy grubs, known as khapra in the Delhi bazaar, where it is said sometimes to destroy as much as 6 or 7 per cent. of wheat stored in godowns."

In "Indian Insect Pests," 1906, Lefroy says (p. 252): "A dermestid (*Æthriostoma undulata*), closely allied to *Dermestis vulpinus,* is reported from India in wheat. This, or the last, is the insect found in grain in Gujarat, where it is believed to be of use in checking other grain insects, notably the red grain weevil. This belief is so firmly held that the dermestid is introduced in the grain infested with insects as a check on them."

In 1909 the same writer says, referring to this insect, "The part it plays in wheat is not ascertained, but it is likely to be predaceous upon other insects there, or to feed on their dead bodies."

In a memoir of the Agricultural Research Institute, Pusa, Messrs. Barnes and Grove, in "Insects attacking stored wheat in the Punjab, &c.," gave an exhaustive account of the life history of the khapra and lesser grain borer, with coloured plates. In conclusion they say, "Investigation has shown that this insect certainly does not play the role suggested by Lefroy in his later note, but is a very active agent in destroying the wheat."

Professor Lefroy may have altered his opinion since the above quotations were written, but so far as I can ascertain he does not appear to have published anything further on the subject.

Both these beetles are very interesting from an economic point of view, as the khapra belongs to a group of carnivorous beetles, which in the first instance found their way in the larval or perfect state into the stored grain to feed upon the original wheat-destroying insects, and, later on, probably through the absence of such food, turned their attention to the wheat grains and nibbled the surface until they adapted them as their food supplies and became wheat-destroyers.

The lesser grain borer belongs to a family of wood-boring beetles, and originally feeding in the wood in which grain or stored foods were packed, made its way out into the contents, found it suitable food, and thus also became a grain pest, the beetle boring into the wheat grains and doing the greater part of the damage.

Their method of damaging the wheat is quite distinct. In the case of infestation by the khapra (*Trogoderma khapra*), the female beetle lays her eggs, averaging from thirty to forty-five in number, among the grains of wheat, the little hairy larvæ going through a series of moults, gnawing the outer surface of the wheat grains until full fed, when they crawl away and pupate in the last larval skin.

The adult beetle varies from brownish-black to reddish-brown in colour, not much longer than broad, rounded at both extremities, with a small head slightly turned downwards, fitting close against the prothorax, furnished with eleven jointed antennæ, the central ones smallest and the last three forming an irregular club, the whole surface of the thorax and wing covers clothed with fine reddish hairs. Length, 3 mm.

This beetle is most active in the hottest and driest part of the Indian summer (May, June, and July), when the wheat is dry and hard. There is reason to believe that under the different climatic conditions in Australia, where we never have such a dry heat as in Northern India, the khapra would not do as much damage as weevil, if it was to be accidentally introduced.

Flag Smut and its Control.

The spores of flag smut (the fine black dusty matter which is observable on crushing a leaf of an infected wheat plant) can reach the wheat grain in two ways:—

(1) Through the soil being well supplied with them,

(2) By adhering to the grain.

If the paddocks have not previously been badly infected with flag smut, then the pickling process, resorted to as a preventive of stinking smut, has also a cleansing value for flag smut. If, however, the paddock has been badly infected with flag smut the previous season, pickling has little or no effect. If possible a rotation crop should be sown to starve the fungus out. Normally the spore germinates about sowing time, when the conditions of moisture and temperature are favourable to it, so that if the young fungus does not then come into contact with a young wheat plant it dies. If wheat must follow wheat, then the land should be ploughed and worked as soon after the harvest as possible. The moisture conserved in this way may result in the germination of the flag smut prior to the sowing. The use of a late variety would then be an advantage.

If stubble from a badly affected crop is not burnt off, a large number of spores drop into the soil. Sowing in a dry seed-bed will usually favour the disease for the reason that, if it contains ungerminated spores, the spore and seed will lie together until rain comes, when they will germinate at the same time, giving the fungus every chance of surviving.

It is important also to note that horses and cattle fed on diseased hay have been shown to pass the spores uninjured and capable of germination. In this way flag smut may be spread from paddock to paddock.

It seems that approved good farming methods—rotation of crops, fallow, early preparation of the seed-bed, conservation of soil moisture, and pickling are our best methods of combating flag smut. A good burn of diseased stubble is also very important.—Chas. O. Hamblin, Assistant Biologist.

What could be done to fill up cracks in a concrete sheep-dip, was lately inquired. Filling with cement had been tried, but without success. The Overseer of Works suggested that the usual cause in such cases is the soakage of surface water getting behind the walls, in which circumstances the trouble might be relieved by cutting off the surface drainage.

"Improved Sires."

An "improved sires" movement is occupying attention in different parts of Canada, legislation, education and propaganda all being laid under tribute to bring under the notice of farmers the value of using better breeding stock. In the province of Nova Scotia a Scrub Bull Act was passed in 1919, providing that the owner of a scrub bull must not permit such an animal to serve any cow within certain limits except a cow owned by himself, and he must not permit it to wander from a properly fenced enclosure unless under the control of a competent attendant. In 1920 the scope of the Act was enlarged, and it is recorded in the *Agricultural Gazette of Canada* that "already there are evidences that this Act has accomplished considerable to drive out the scrub sire, and to establish the supremacy of the pure-bred sire."

In the province of Saskatchewan, the Government assists farmers to procure pure-bred sires, purchasing bulls for cash and selling them on terms. In 1913, 19 bulls were so distributed, in 1916 the number was 150, and in 1919 it reached 195.

Phalaris bulbosa and Chilian Clover at Dorrigo.

Mr. W. A. Parberry, Corridgeree, North Dorrigo, writes:—

Phalaris bulbosa was sown 22nd April and germinated well. It did not suffer from frost like the clovers. It is now partly in head and about 2 feet high. It appears to be a very good winter grass, keeping very green and succulent all through the heaviest frosts. I also sowed a little of this seed in stump ashes where cattle grazed all through the winter, and it did wonderfully well.

Chilian clover was sown at the same time. Frosts set it back severely, but it came away immediately the mild weather set in again. It is now 15 inches high with lovely foliage. I am exceedingly pleased with this clover. I sowed a little seed in burnt stump ashes, and the growth has been luxuriant and vigorous, despite the fact that cattle grazed on the field all the winter.

Canada's Outlay on Agriculture.

Agricultural experiment work and education are fully appreciated in Canada. The Dominion Parliament made appropriations totalling 4,366,000 dollars for the year 1920–21, as against 3,648,000 dollars for the previous year.

This does not take account, of course, of the amounts voted by the various provincial legislatures. In Ontario, the vote for 1920 was 1,594,500 dollars, as against 1,339,932 dollars in the previous year; the amount did not include 336,000 dollars granted by the Dominion Government. In Manitoba, the provincial vote for 1920–21 was 582,490 dollars, as against 476,605 dollars for 1919–20. In Alberta, apart from certain votes chargeable to capital, there was allocated for 1920–21, 602,745 dollars, as against 552,354 dollars for the previous year.

Farmers' Experiment Plots.

MAIZE EXPERIMENTS, 1919-20.

Central Coast District.

J. M. PITT, Assistant Inspector of Agriculture.

MAIZE trials were conducted with the undermentioned farmers during the season 1919-20:—

A. H. Norris, Mount George, Manning River.
E. L. Andrews, Mount George, Manning River.
R. Richardson, Mondrook, Manning River.
W. H. Duffy, "Barham," Comboyne.
G. A. Andrews, Charity Creek, Manning River.
W. Smith, "Bona Vista," Paterson.
Alex. Smith and Atkins Bros., Bandon Grove, Dungog.

The season was a good one, and yields much above the average. The winter and early spring months were dry, and farmers took advantage of these conditions to prepare fields earlier than usual. This procedure had the dual effect of sweetening the soil and in many instances conserving portion of the heavy autumn rainfall. Dry conditions continued throughout the coast until late October, when a general break up of the drought took place. Excepting for a short dry period in December, the remainder of the season continued favourable.

Along the Macleay rain came in time to "crown" the plots sown early, and it is many years since such enormous yields have been harvested in that district. Some yields obtained by farmers along the Manning were records, those obtained in the competitions conducted by the Agricultural Society in that district being well over 100 bushels per acre.

The cultural methods adopted by the experimenters were on the whole sound, although one or two are still "out of line." The too constant use of the roller, and the leaving of a rolled surface from which moisture evaporates rapidly, and which rain quickly hardens, is a procedure not recommended. The use of the disc cultivator instead of the usual ploughing just prior to sowing, is a practice adopted by many of the successful growers; it brings the plot into excellent tilth, only the surface few inches being worked. Further, the work can be done more expeditiously this way than by use of the plough. This applies chiefly to those areas kept in fairly good order during the winter and after the first ploughing, and not to those having a hard rolled surface; these invariably require a ploughing.

A great many of the Macleay farmers rely on the growth and turning under of crops, such as field peas and vetches, to maintain the soil fertility. This is a sound method, but the application of small amounts of fertilisers, such as superphosphate, would also be highly beneficial.

Owing to the continued drought and scarcity of all classes of fodder in the "back" country, practically all the grain was despatched for starving stock. Record prices were obtained. The available figures for the rainfall were as follows:—Mount George: September, 108 points; October, 215; November, 199; December, 507; January, 729; February, 284; March, 202. Mondrook: September, 196 points; October, 114; November, 127; December, 155; January, 692; February, 264; March, 128. The yields obtained are shown in the following table:—

MAIZE Variety Yield.

Variety.	A. H. Norris, Mount George.	E. L. Andrews, Mount George.	W. Smith, Paterson.	*B. Richardson, Mondrook.	Alex. Smith, Bandon Grove.	W. H. Duffy, Comboyne.	G. A. Andrews, Charity Creek.
Date Sown.	11 Oct., 1919.	9 Oct., 1919.	27 Sept., 1919.	22 Oct., 1919.	13 Nov., 1919.	4 Nov., 1919.	29 Sept., 1919.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Improved Yellow Dent	85 11	63 37	..	81 14	112 14	...	71 0
Golden Nugget	...	58 24	...	71 14	95 46	32 23	...
Yellow Horsetooth	...	...	...	...	107 31	...	90 0
Yellow Mastodon	...	...	...	71 28	..	...	...
Leaming	...	59 31	...	78 42	96 3	35 29	70 0
Leaming (farmer's seed)	...	...	..	...	...	41 5	...
Yellow Hogan	...	...	...	...	106 21	...	...
Red Hogan	...	72 44	...	74 28	...	...	...
Narrow Red Hogan	87 40	...	...	72 28	109 53	...	...
Silvermine	...	..	76 0	65 0	..	42 13	...
Manning White	...	...	...	91 14	...	...	...
Golden Beauty	...	67 43	...	80 28	...	...	..
Golden Superb	66 0	...	48 0	...	...	12 14	63 0
Kansas Sunflower	...	51 19	...	71 42	...	..	70 0
Palecap Horsetooth	...	...	...	77 42	...	...	...
Golden King	...	63 37	..	...	...	...	...
Golden Glow	...	...	49 0	...	...	...	...
Funk's Dent	78 28	...	75 0	...	...	...	...
Boone County White	...	...	...	73 42	...	...	...
Early Yellow Dent	...	...	49 0	...	...	...	...
Eureka	...	48 7	...	...	...	...	...
U.S. 133	45 5	...	33 0	...	...	20 7	...
Star Leaming	78 33	41 4	...	...	...	...	...
King of Earlies	...	...	...	...	...	48 31	...
Yellow Dent (farmer's seed)	86 39	...	...	...	...	...	...
Small Red Hogan	...	43 7	...	...	...	14 13	...

*Fertiliser, 2 cwt. P7.

Of varieties grown, Improved Yellow Dent is still the most popular; its adaptability to all kinds of weather and soils places it in a class by itself. Its bright attractive grain also makes it one of the best for market. Other constant yielders were Yellow Horsetooth, Golden Nugget, Leaming, and Manning White. Of the earlier maturing varieties Funk's Yellow Dent gave good yields, and is fast becoming a popular variety for early sowing on the Manning. Golden Superb is still the most widely sown early variety for the

Macleay, farmers having it on the market usually in January. U.S. 133—a new very early variety—sown on 26th August, was pulled on 6th January (barely 4½ months later), and yielded nearly 60 bushels to the acre.

The season was not a bad one for fungus or insect pests. The Comboyne plots were, as usual, most affected, late blight greatly decreasing yields.

Green Manuring Experiment.

To demonstrate the value of green manuring, an experiment designed to extend over a number of years was commenced on the farm of Mr. E. L. Andrews, Mount George. Three plots were included in the experiment for the first season, these comprising—(1) a plot on which field peas were grown for turning under; (2) one on which barley and vetches were grown for that purpose; and (3) one on which, for purposes of comparison, the method customarily adopted by Mr. Andrews and neighbouring farmers was practised. This method consists of ploughing the land shortly after the removal of the previous maize crop (usually about the end of April or May) with a 28-inch disc single-furrow plough, all stalks, weed growth, &c., being turned well under. During the winter the fallowed land is sometimes worked to destroy weed growth and to keep the surface loose; then, before sowing, the field is again ploughed 4 to 6 inches deep.

This method of cultivation is sound, for it aims at moisture conservation and the sweetening of the soil, and is far preferable to the methods adopted by many farmers, which leave the field "dirty" until just prior to sowing.

Field peas were sown at 1 bushel to the acre, barley 1 bushel, and vetches 12 lb., on 13th May, 1920. Good growth eventuated on both the green manure plots. The three plots were ploughed on 1st October, rolled and harrowed, and maize was sown on 15th November.

Considering the dense mass of green manure turned under, the time allowed for its decomposition prior to the sowing of the plots to maize was hardly sufficient, and it was not surprising that the early growth of maize on the green manure plots was inferior and yellowish compared with the growth on the fallowed plot.

As the season advanced, however, the growth of maize on the field pea plot was in appearance superior to all the others. The maize on the barley and vetch plot, owing to the great bulk of the crop turned under (about 10 tons as against 6 tons of field peas), made poor headway throughout.

Nearly 11 bushels more grain per acre were harvested from the field pea plot than from that treated by the farmers' method, and 30½ bushels more than from the barley and vetch plot. The yields were as follows:—

	bus.	lb.
Plot No. 1. Green manured with field peas	77	0
Plot No. 2. Green manured with barley and tares ...	46	33
Plot No. 3. Farmers' plot	66	37

The results so far have proved interesting to the neighbouring farmers, many of whom grew field peas during the winter.

The Culture of Sugar Cane in New South Wales.

[Continued from Vol. XXXI, page 859.]

A. H. HAYWOOD, Manager, Wollongbar Experiment Farm.

The Burning of the Trash.

THE first operation that follows the harvesting of the cane is the burning of the trash. The dead and dying leaves that remain on the ground after the crop is cut and removed must run into several tons per acre, and it is impossible to avoid the regret that so much vegetable matter must be destroyed. Might it not be allowed to lie on the surface until it can be ploughed under, and thus returned as humus to the soil that produced it? The idea looks attractive, but the trash harbours much in the way of fungi and insects, and the practice would almost certainly be attended by an increase in the number of enemies with which the ratoon crop would have to compete. Where a stand is being ploughed out it might be permissible to allow the trash to remain on the surface and plough it under when breaking up the cane stools; but even there the practice has the obvious objection that if the land is to be replanted at once to cane, the young plants will have plenty of enemies waiting them in the soil. If some other crop, such as maize, or a renovating crop such as cowpeas, is to occupy the ground for a year before the land is replanted to cane, no doubt the interval would be sufficient for the spores of the fungi to be starved out, and in such cases the trash might be turned under with a measure of safety, but the practice cannot otherwise be commended.

One farmer on the Cudgen area, complaining that his land was becoming exhausted (after thirty years of cane-growing with practically no intermission), intimated his intention to let the trash lie on the ground; he thought perhaps the burning of the trash every couple of years was burning the fertility out of his land. What the result may be we have yet to see, but he certainly could adopt better methods of maintaining fertility and would find them no greater drawback than the loss of a season. As the variety with which he was making the experiment was Malabar—strong growing and hitherto fairly free from disease—the result may not be so bad, but at the best the method is a dangerous one.

Where the crop has been cut very early in the season, and there is danger that frost may catch the tender shoots of the following ratoon crop, it is better to let the trash lie on the surface until the risk of frost is past, for the young plant is exceedingly tender, but even this must be with the reservation that any fungi present will become busy at the first improvement of the weather, so that the firestick must be put in as early as possible.

Cultivating the Ratoon Crop.

The trash being thus disposed of, the farmer must set about the cultivation of the stools in view of the ratoon crop. In the sugar cane districts of New South Wales, farmers look to get at least two cuts of cane from a stand —one "plant" cane and one ratoon—but quite frequently the stand is good enough to yield three ratoon crops (or four cuts in all).

The first operation on behalf of the ratoon crop is a thorough deep ploughing between the drills to open up and aerate the soil, working close to the stools with some disc implement that will act as a root pruner. Distinct advantages lie in thoroughly opening up and exposing the stools to light and air for a short time. A good many farmers still prefer to plough on to the stools at this stage, but others among the most successful growers find that ploughing away from the plants cuts off the old roots that have fulfilled their function, and encourages the formation of a new and more vigorous root system on the sides. Thus invigorated, the stools have a firmer hold on the ground, and from the roots send up better canes than if the lower remaining nodes of the canes lately harvested are allowed to shoot again.

The methods of effecting this root pruning vary a great deal, a few carrying it out on all four sides, others doing it on three sides out of four, and others again two out of four sides, contenting themselves by "ploughing on" on the remaining sides. The implement used is generally a mouldboard plough with disc coulter attached.

Shaving the ratoon crop stubble just below the surface has a very stimulating effect on cane, but it is an operation that has so far been done by hand, and cane-growers are still awaiting the introduction of a horse-power implement to perform the work economically.

It is interesting to add that farmers have observed that where tram lines have been laid for the removal of the cane, those stools that have to be trimmed hard in levelling the track are often the best in the whole crop.

Where this root pruning does not form part of the farm practice, it is usual to give a thorough working. The after-cultivation in both methods is with the disc cultivators until the growth of the cane again puts an end to all such work.

A method of ratooning adopted at the Mackay Sugar Experiment Station in Queensland was lately referred to by the *Queensland Agricultural Journal* as giving large yields of ratoon crops. It is applicable to only a limited area of New South Wales, but it is perhaps worth quotation:—

"It is believed that the best method of securing large yields of ratoon cane is to adopt the following procedure:—Immediately the trash is burnt, open up the middles of the rows to a depth of 9 inches with the swing plough; next subsoil these two furrows so that a further depth of 6 inches is thoroughly stirred. Next plough away from the cane rows on to the middles and again follow with the subsoiler. By this means the whole of the ground between the rows has been moved and stirred to a depth of 15 inches;

and the benefit to the ratoons in thus breaking up the hard ground and letting in air and sunlight is difficult to over-estimate. Subsequent shallow cultivation with broad hoes should now be practised frequently.

"The results obtained at the Experiment Station, due to this method of cultivating ratoons, are detailed in the table below:—

Crops.	Ground between rows, ploughed and subsoiled.	Ground between rows ploughed to 8 inches.
	Yield in tons.	Yield in tons.
First Ratoon	38·9	27·0
Second Ratoon	31·3	19·2
Third Ratoon	20·4	9·91

"These experiments were not fertilised."

Rotation.

It is convenient before turning to discuss the varieties of sugar cane grown in this State, to say a few words on a subject to which allusion has been made several times in these articles, and to which we are assured farmers will be compelled as time goes on to devote more and more attention.

Rotation of crops lies at the very basis of good farming. In certain countries (chiefly countries where farming has been followed for many years) a systematic rotation is specifically prescribed in the mortgages and leases under which land is commonly held, so well do owners and tenants recognise it as an essential part of good husbandry. New land may yield profitably under one crop for a few years, but do so indefinitely it will not. Sooner or later a change becomes imperative.

Continuous cropping brings with it depletion of the vegetable matter in the soil and declining fertility, and it permits the invasion of diseases and pests that increase in the vigour of their attacks as the strength and virility of the crop declines. Postpone its effects in various ways we may attempt to do, and even with a measure of success, but deliver ourselves from this law of nature we cannot. Wheat farmers have learned it; so have maize farmers; Americans, with all their resourcefulness have not been able to avoid it; the patient farmers of civilisations thousands of years old have bowed to its dictates, and the cane-growers of our northern rivers cannot claim exemption.

We have already indicated that this is a phase of things not unknown on the Clarence, Richmond, and Tweed, but the theory—excellent thing that it is—has yet to be put into common practice. No doubt legumes are grown from time to time and ploughed in between two cane stands, but the complaint "that we do not get the yields we once did" has but one answer.

The cane-grower is in the fortunate position, too, that crops suitable for the purpose and capable of returning a reasonable profit without undue loss

of time, offer themselves. Maize, for instance, can be sown after the stools have been ploughed up, and harvested early enough to allow a short fallow before the next cane crop can be sown. We have indicated at an earlier stage, too, that many cane-growers have found that the land can be profitably sown with grasses and clovers, or even allowed to lapse into couch grass pasture and devoted to dairying for a few years. The effect is the renovation of the soil, and the starving out of fungi that have established themselves, and the crops of cane obtained when the land is returned to the main crop are instructive as well as profitable.

The possibilities of change of crop are thus considerable and should be attractive.

The Utility of Legumes.

It is opportune, however, to urge upon farmers the use of legumes more extensively. If the fertility of the soil is to be maintained under such conditions as sugar cane demands, it can only be by the growth of crops with the specific object of maintaining humus. How efficient legumes are for this purpose our growers of cane already well know. How little they make use of them we have already indicated. Yet, excellent legumes offer themselves for each of the rivers. On the Clarence and Richmond, for instance, cowpeas produce heavy crops of foliage, and of seed in summer, and vetches do well in the winter. On the volcanic soils of the Tweed, Florida velvet and Lablab beans make vigorous growth in summer, and vetches have proved their ability to make good growth in the winter. One farmer on the Clarence affirmed that if growers would make it their practice to take no more than two cane crops (the plant crop and one ratoon) from their land, and then sow cowpeas, they would do better than by following one cane crop close upon another. He advocated sowing early maize, thinly, about 8 lb. per acre, and then after the maize was up, sowing 7 or 8 lb. cowpeas per acre with the maize drill between the rows. The maize would be harvested in February, and the cowpeas and stalks then ploughed in. A month later field peas should be sown as a winter crop to be ploughed in in spring. This farmer went so far as to advocate two maize crops (with cowpeas) and two sowings of vetches before the land should be worked up for the sowing of cane again. No doubt it looks somewhat heavy, but he has been one of the most successful growers of cane on the Clarence, and knows the value of maintaining the fertility of his land.

But the combinations that suggest themselves for judicious associations with cane are quite numerous. What is necessary now is not their reiteration, but the practical application by farmers of the methods they all approve and acclaim, but too few adopt. The advantage is real. In Louisiana a crop of velvet beans, turned under in 1917, is credited with adding 25 per cent. to the cane grown on the same land the next year, and on the Clarence at least one farmer can testify that whereas his land had run down to crops of 10 tons per acre of ratoon cane, renovation with maize, cowpeas, and vetches successively was followed by crops of 60 tons of plant cane. It is the translation of our knowledge into habit that we want.

Manures and Fertilisers.

Fertilisers are not extensively used. Trials have been conducted by different farmers in their own ways, but properly arranged experiments are required before anything definite can be said. Appearances seem to indicate that provided the fertility of the land is well and properly maintained, the only utility of the fertilisers is in connection with the ratoon crop. Some farmers favour bonedust with a little blood added, others again have had fair results with a complete fertiliser, and yet others again have been well pleased with their experience of nitrate of soda. It can be said with some certainty that fertilisers are likely to be profitable when used on the green manure or rotation crops, and they should not be omitted when maize is sown.

(*To be continued.*)

A Case of Spring Dwindling.

"I have met a problem this spring that has me beaten," wrote an apiarist to the Department recently. "I have four colonies which did well over winter, but now the bees are lying dead quite thick in front of the hives. The comb seems quite good, and is filled with eggs and young bees, but there is very little honey, although the weather has been good. The bees appear to me to have been carrying on a wholesale slaughter among themselves for the past ten days. . . In one hive I think they are uncapping the young bees and killing them."

It is considered that the colonies are affected with spring dwindling, replied the Senior Apiary Inspector. This malady does not often cause the complete collapse of the colonies, although the population is often somewhat depleted. The cause of the trouble can usually be traced to some abnormal condition experienced during the previous autumn or winter months, such condition having lowered the vitality of the bees to such an extent that a large number are unable to resist the spring disease (probably caused by the parasite *Nosema apis*). In some cases the bees are simply not in a condition to stand heavy spring work and die off rapidly in the attempt to carry out their duties.

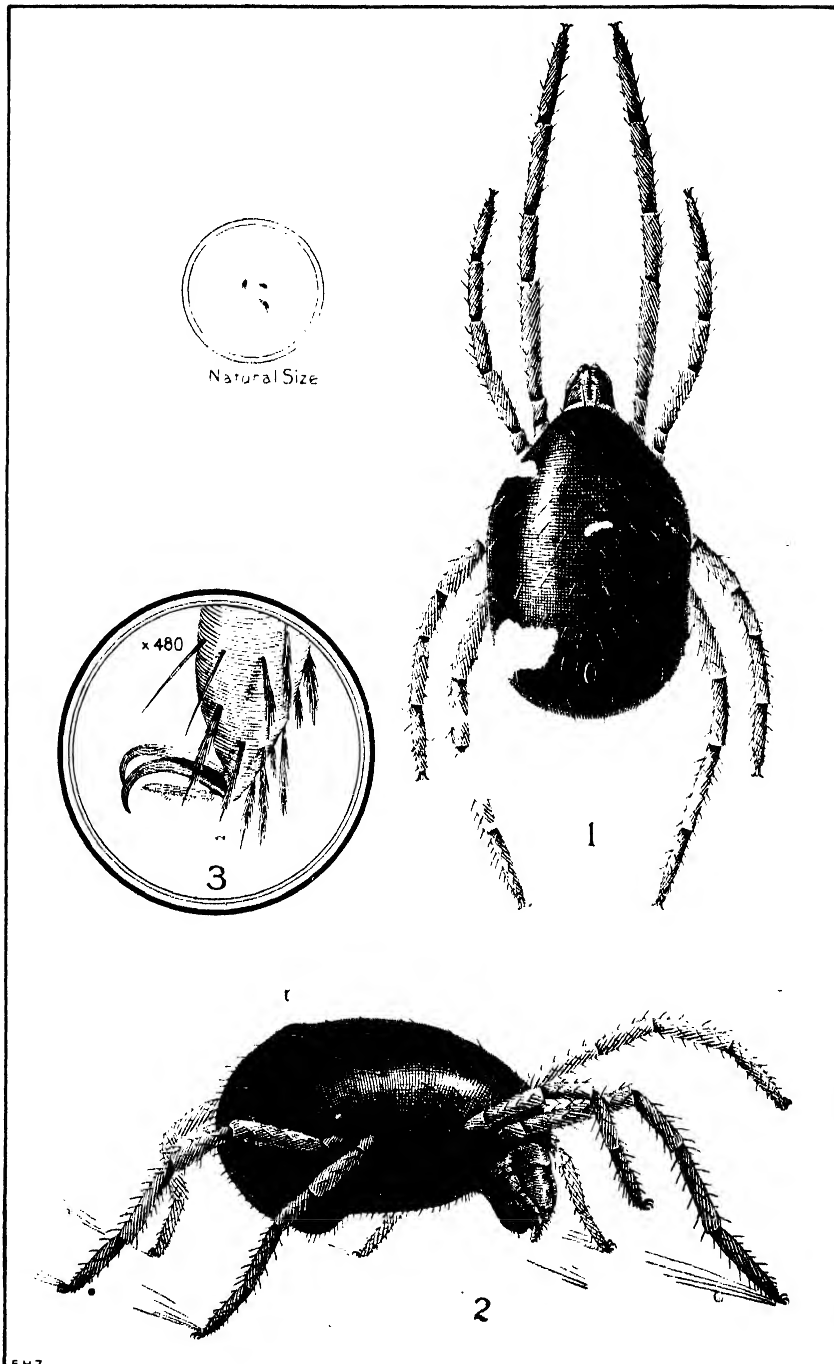
What appears to be fighting at the entrance of the hives is probably the effort of healthy bees to rid the hives of the infected members of the community. Concerning your other impression, it is unlikely that the bees would uncap the brood unless on the verge of starvation, and even then the sealed brood is rarely interfered with. It is unlikely that the young bees are being removed; it is more probable that, owing to the condition of the colony, some of the emerging bees are affected through malnutrition.

The dwindling should disappear when good conditions prevail; meanwhile, see that the bees are not kept so short of stores that they must economise. Stimulating conditions can often be brought about artificially by feeding sugar syrup, when warm, inside the hive—say five or six pounds in one quantity. The syrup is made by mixing sugar and water in equal portions by volume and constitutes a valuable change in food.

Mahona Cane at Duck Creek Experiment Farm.

Estimated yield, 45 tons per acre.

Loading Cane on to a punt on the Tweed River.



The Blue Oat Mite. (*Notophallus bicolor*).

1. Dorsal view of Mite. 2. Side view of Mite. 3. Foot of adult Mite

The Blue Oat Mite

(*Notophallus bicolor*, n.sp.).

W. W. FROGGATT, F.L.S., Government Entomologist.

DURING the early part of last August the farmers in the Delungra district noticed that some pest or disease was attacking their young oat crops, and about the middle of that month Mr. John Fraser discovered that the flag of the oats on a 15-acre paddock was covered with small insects. Some of these Mr. Fraser collected and forwarded to the Department of Agriculture. On examining them I was surprised to find that they were a round-bodied mite belonging to the soft-bodied mites of the family *Eupodidae*.

On 20th August I visited the district and was able to investigate the extent of the damage and study the pest under natural conditions among the infested oats. The damage was confined to the paddocks of black and Algerian oats, and the mites had not spread over the adjoining fields of wheat or barley. Excepting the variegated thistle, which here and there in the infested oats was thickly covered with mites, and in a sickly yellow condition, none of the weeds were touched by the insect; but in the first paddock visited one could notice, even from a distance, all the flag of the oats turning yellow and brown at the tips, looking as if it had been badly nipped with frost. The mites, with dark blue bodies and bright red legs, were clustered on the upper surface of the flag of each stool of oats in countless thousands. They were very active, and the moment one touched the leaf they dropped off and hid. The crop was about 8 inches to a foot in height, very luxuriant and thick in consequence of the constant heavy showers; but the moist condition and rank growth seemed to suit these mites.

In the next crop examined, the owner, finding it changing colour through the mites' presence, had turned his stock in the paddock, and much of the crop had been eaten off, or trampled in the mud. Yet there were still multitudes of mites on the upright stalks, and quantities of dull red oval eggs were found at the base of the stools. Many stalks in this paddock were limp and decaying; but this may or may not have been caused by the mite infestation.

Under the circumstances—owing to the drought there was not a green thing growing in or about these paddocks last season—two queries inevitably arise: Where did this mite originate and what was its first food plant? Large quantities of chaff for feeding starving stock from all parts of the country were brought into the district during the drought, but it does not seem possible that these soft-bodied mites or their eggs could have been introduced into the district in this manner. The area of infestation, as far as I could learn, was about 5 miles round the township of Delungra.

Mr. C. French, junior, Government Entomologist, Victoria, informs me that a similar, if not identical species of mite appeared last August in Victoria, doing a considerable amount of damage to the potato, pea, lucerne, and other crops.

Description of Group.

This mite belongs to the soft-bodied group included in the Family *Eupodidae*. They have rather long legs, usually bright red in colour, and the darker body shows more or less well defined transverse lines or divisions bearing scattered hairs. Some of them have eyes; the mouth parts are simple, consisting of short thickened four-jointed palpi with rather small mandibles. The legs are six or seven-jointed, terminating in a pair of claws and usually with a plumed pulvellus. Banks says, "Some of the best-known mites belong to this family, usually found in damp localities mostly upon the ground. Some, however, are found on the leaves of trees. Many are carnivorous, feeding upon smaller creatures and the eggs of insects."

The members of the Genus *Notophallus*, to which our pest belongs, are all dark-bodied creatures, with red legs, with a red spot on the basal portion of the dorsal surface of the body. They are found in damp fields. Banks says: "Species of *Notophallus* have been found to be injurious to young plants, the mites sucking the leaves, and frequently causing the death of the tiny plants. One form is very injurious in the south-west." I can find no record of any species having been recorded from Australia, and therefore propose to call it the "Blue Oat Mite."

Description of Species.

Mouth parts and legs bright red; body deep dull blue, with an oval red patch on the apical portion of the dorsal surface of the body, another on the under surface, and a dull blotch of the same colour behind the head; both the legs and body covered with short scattered white hairs. When resting on the plant they appear to have a white spot on the anal opening on the back, but this is produced by a drop of liquid on the anal orifice on the centre of the red spot. On a level surface they can run very rapidly and are difficult to catch uninjured, as their bodies are so soft that the least touch crushes them.

Mouth parts projecting, rounded in front; palpi thickened, rounded, first joint large, second short, third about the same length but smaller and rounded to the tip. The body rounded and slightly oval, with three or four impressed transverse lines like segmental divisions. Legs long, the first and fourth pair longer than the second and third pair; the second joint is longest and the third shortest. Length of body, 1 mm. Length of body and extended legs, 2½ mm.

BANANA passion fruit is more suitable for decorative or shade purposes than for utility as a commercial article. The fruit is not particularly attractive in appearance; it lacks flavour, is inclined to be sub-acid, and as a delicacy is not to be compared in any way with the common variety of passion fruit.—S. A. HOGG.

Neutralisation of Over-ripe Milk for Cheesemaking.*

J. G. McMILLAN, Dairy Instructor.

ONE of the greatest troubles that the cheesemaker has to contend with in this State, particularly at factories where supplies come from a number of sources, is that arising from milk which arrives in a condition too ripe for use in the production of first-class cheese. There is hardly any doubt that bad milk is responsible for a great deal of the bad cheese to be found on the Sydney market, and the generally accepted opinion is that during the last few years the quality of the cheese has gone backward.

Bad milk is mostly attributable to the supplier, but considerable contamination occurs through the conveyance of whey back to the farms in the cans in which the milk was brought to the factory

As it will be impossible for factories to obtain ideal milk until legislation to deal with the dirty dairyman is introduced, the cheesemaker must for the present apply himself to making the best possible article from the raw product, for he receives both contaminated and over-acid milk, and in the summer months a considerable amount of the latter. Over-ripe milk is usually so termed when showing over ·24 or ·25 per cent. lactic acid (though in the warm weather the night's milk is often higher in acidity). In the manufacture of such milk into cheese, various processes for modification are in vogue, but the following are the two most generally used:—

METHOD No. 1.

1. Rennet at lower than the usual temperature, say 82 deg. Fah.
2. Add more rennet.
3. Cut curd finer.
4. Heat curd quicker and to a higher temperature.
5. Draw whey sooner than with a normal curd, and in certain cases complete cooking process in water.
6. Stir curd well after drawing whey and before cheddaring.
7. Pack shallower, if any, during cheddaring process. The depth of packing to be regulated by the firmness of curd.
8. Mill and salt earlier.

With a milk that is not very acid this method acts fairly satisfactorily, but when the working is likely to be extra fast the next method is preferable.

METHOD No. 2.

1. Set at a higher temperature than usual (say, 90 deg. Fah.) and add more rennet.
2. Cut finer
3. Heat to about 105 degrees Fah. in cooking process.
4. Draw whey off whilst cooking process is going on, and as quickly as possible after desired temperature has been reached.
5. Put curd on racks and stir well. Pile very little, but sufficient to bring about a good cheddar.
6. Mill curd when acid shows ½ to 1 inch acid on hot iron.
7. Allow curd to mellow fairly well after milling.

* Condensed from Farmers' Bulletin, No. 136, in the press.

The second method is the one that I have practised and recommended for some years. The main difference, as compared with the first, is the setting temperature. Prior to renneting, accidentally, at a high temperature a high acid milk, and obtaining from it a first-class cheese, I practised the usual method, but in the final test in experiments at Moruya factory, I adopted the second method in a comparative trial with neutralisation. In dealing with over-ripe milk the object of the cheesemaker is to have the whey expelled from the curd before excess acid has developed. By setting at, say, 90 deg. Fah., and adding more rennet, coagulation is brought about more quickly, and a more rapid expulsion of whey therefore takes place. Another advantage is that the heat necessary to raise the milk to cooking temperature is less than that required to set at 82 deg. Fah., while there is also less danger of locking in moisture during the cooking process. When setting at a high temperature, it is necessary thoroughly to dilute the rennet and only to stir for a moment or two, as coagulation may occur in less than a minute. Experiments have given better yields with the second method than the first.

Although fairly good results can be obtained from over-ripe milk by the aforementioned methods, it was thought that owing to the success attained by the neutralisation of cream for buttermaking, similar treatment of milk for cheesemaking might prove beneficial. The Dairy Branch of the Department of Agriculture gave consideration to this matter as far back as November, 1917, and arrangements were made to commence a series of experiments to be conducted over the summer season of that year. Owing, however, to the officer who was to have carried them out leaving the State service, the experiments had to be postponed. Investigations were resumed at the commencement of the summer of 1918 by Mr. A. T. R. Brown, acting under instructions from the Dairy Expert. These first tests, although to a certain extent unsuccessful, were required in order to eliminate or modify those methods and neutralising agents which were unsuitable.

With a view of obtaining further information on the merits or demerits of neutralisation, in conjunction with Mr. O. C. Ballhausen I carried out a series of experiments at Bangalow, one point being firmly stressed—the necessity of first neutralising the milk. The neutralisers used were caustic soda, bicarbonate of soda, and washing soda.

The highest degree of acidity allowed to develop in the milk was ·26 per cent. That treated with caustic soda produced the best result, the matured cheese being good in texture, colour, and flavour. The colour was perfect. The curd in this case at the salting stage appeared to be too soft. It was found that though the acid was reduced in the milk to ·18 per cent., in the subsequent processes of manufacture the development of acid was quite as rapid as with the curd from a non-treated milk, owing to the alkali only reducing the acid and not the number of bacteria producing it. The process of coagulation was also prolonged, which further assisted bacterial development. The addition of a small amount of calcium chloride remedied the coagulation defects. Bicarbonate and carbonate of soda both produced a gassy

curd, owing to the evolution of carbonic acid gas (CO_2). It was consequently made apparent that the use of a carbonate in milk was impossible. Caustic soda was therefore considered to be the only practical chemical to use, as bringing about a rapid reduction of acid without production of gas.

Having discovered that milk could be properly neutralised by this means it was necessary to adopt methods that would check the rapid development of acid after neutralisation was accomplished, and bring the milk to such a condition that the whole process of cheese manufacture would be about six hours from renneting to salting. Our knowledge of pasteurisation guided us in this respect. Pasteurisation, however, reduces the coagulating properties. Laboratory tests proved that the addition of calcium chloride with milk heated to various temperatures, restored rennet action. At Bangalow, Mr. A. A. Ramsay (Principal Assistant Chemist of the Department of Agriculture) and I conducted a series of experiments extending over three weeks, when milk was raised to various degrees of acidity as high as ·7 deg. After neutralisation and subsequent pasteurisation to a temperature of 150 deg. Fah., and after being held at that temperature for twenty minutes, the milk appeared to have an excellent flavour—indeed, it was devoid of all taint. The curd in most instances appeared to be of good flavour, but very slow in developing acid. The cheese, however, was of very poor quality. The milk was not of the best, and the probability is that the pasteurising temperature was insufficient to destroy undesirable organisms; but as the desirable organisms would be destroyed, a free field would be left for the undesirable, which would account for the bad flavours in the cheese. The results of this experiment, after three weeks' hard work, were discouraging.

Experiments at Moruya.

In May, 1919, Mr. A. T. R. Brown and I conducted experiments at Moruya Cheese Factory, as a result of which the following conclusions were arrived at:—

1. That with milk showing acidity up to ·31 per cent. the use of lime in the whey only does not produce such good results as those obtained by skilful working under the fast-working method.
2. That in the case of milk not exactly over-acid but inclined to work fast, the addition of lime-water will assist in firming the curd; that the use of free lime is not to be commended, as it sets up decomposition of the proteid matter and produces ammonia.
3. That the neutralisation of high acid milk to a normal degree of acidity by means of caustic soda, using lime-water in the whey, will produce a good marketable cheese; and that the soda must be well diluted with water and stirred rapidly through the milk.

Experiments at Seven Oaks.

As the Moruya experiments had been carried out in cool weather, it was necessary to make further experiments during the warm period of the year, when milk is likely to arrive at a factory in an advanced state of ripeness. Seven Oaks Factory, Macleay River, was selected as a suitable place for the

investigations, and here, assisted by Mr. A. McPhillips, of the Dairy Branch, I conducted further experiments. Some deviation was made from previous procedure during the latter period of the investigations. All the milk delivered to a cheese factory is not over-ripe, only a small percentage generally being so. It was therefore assumed that 50 per cent. of the milk was in an over-ripe condition, and in the latter period of the experiments, night's milk which had developed high acid was neutralised with soda and then pasteurised and subsequently mixed with about an equal volume of raw morning's milk. By this means it was thought the effect of pasteurising the night's milk would not interfere with the coagulative properties of the mixed milks, which conjecture proved fairly accurate.

This series of experiments showed:—

1. That if over-ripe milk is first neutralised with caustic soda, pasteurised and mixed with sweet milk, it will produce good cheese. Pasteursing must be done by the holding system; if done by the flash system, when a large quantity of neutralised milk is being treated, acid will be developing all the time, and the latter part will probably coagulate when heated. The batch system allows of a quicker checking of bacterial action.
2. That with milk moderately over-acid, the working of the curd under the fast method (No. 2) will produce results as good, if not better, than those produced by neutralisation if the sour portion is not pasteurised.

The cheese obtained from the various lots of milk was judged on two occasions for flavour, texture, and condition. The points allotted the first time are not shown in this summary, but those allotted as the final judgment on 28th June are given in full with remarks.

Significance of the Experiments.

The probability is that further experiments will show that sour milk can be neutralised, pasteurised, and made into first-class cheese without the addition of untreated milk if artificial acids are added prior to renneting, so as to assist in the expulsion of the whey from the curd. Further experiments should be made to prove this. I am quite satisfied that sour milk can be successfully treated, provided the whey is not separated from the curd. It must be borne in mind, however, that the experiments herein described were designed to discover a treatment which must be regarded primarily as of an emergency nature, and as dealing with a condition which should not be considered in any degree properly normal. The endeavour to determine the best method whereby sour milk may be utilised must not, in short, be regarded as support of the milk supplier in the practice of sending sour milk to the factory.

The treatment of sour milk incurs a certain amount of expense and extra labour. The policy of grading and paying for milk in the same way as is done for cream at butter factories would recompense the cheesemaker for his extra trouble and assist in reducing the percentage of sour milk.

Concerning the use of caustic soda in milk, it may be remarked that this appears to many persons like the adding of a poison; yet the chemical change is exactly the same as by adding either carbonate or bicarbonate of soda, excepting that the two latter produce CO_2 (carbonic acid gas). In all three cases the resulting salt, by the combination of the sodium base with the lactic acid, is sodium lactate. The amount of caustic soda required is comparatively small, ·7 oz. reducing the lactic acid by one point in 1,000 lb. of milk. For example, 100 gallons of milk arrives at a factory showing ·35 per cent. acid, and it is desired to reduce the acidity to ·22 per cent. before pasteurising. This requires approximately 9 oz. of soda, costing about 4½d.

Conclusion.

The final grading proves that the system of manufacture adopted during the latter period of the experiments can be confidently recommended, and although the system of dealing with over-ripe milk is not yet perfect, the investigations so far as they have gone may be considered thoroughly practicable. It is further evident that over-ripe milk partially neutralised with caustic soda (NaOH) and lime-water used in the whey will assist in improving cheese, but the process cannot be said to be as thoroughly reliable as neutralising with caustic soda and subsequently pasteurising.

Since these experiments were completed, milk of varying degrees of acidity, some containing as much as ·6 per cent. lactic acid, has been neutralised, then pasteurised, and manufactured into good quality cheese without the addition of untreated milk.

POINTS allotted in Final Judging on 28th June, 1920, to Cheese manufactured from different lots of Sour Milk.

Lot.	Flavour.	Texture.	Condition.	Total.	Method under which Milk was treated.	Remarks.
1 A...	37	28	19	84	Calcined magnesia and lime in milk.	The previous unclean flavour turned into a fruity flavour; there was openness in texture, but broke fairly well; colour was irregular.
1 B...	39	28	19	88	Untreated.............	Previous unclean flavour more pronounced; texture short and rather crumbly; colour fairly clear.
1 C...	38	27	18	83	Calcined magnesia and lime.	Bad flavour; open and crumbly; bleached colour.
1 D ..	41½	29	19½	90	Untreated	After flavour unclean slightly but not objectionable; texture a little short but close; colour slightly irregular.
1 E...	37	29	19	85	Magnesia, caustic soda, and lime.	Flavour very insipid, deteriorated considerably from previous examination; difficult to define, evidently flavour is or may be due to the presence of undissolved magnesia in the curd; texture close but does not break too well; colour dull.

POINTS allotted in Final Judging—*continued.*

Lot.	Flavour.	Texture.	Condition.	Total.	Method under which Milk was treated.	Remarks.
2 A...	40	29	19	88	Untreated milk. Acid in whey reduced to ·15 with NaOH.	Unclean flavour developed since previous examination; texture close and body firm; colour slightly irregular. As this cheese was made from milk containing ·31 per cent. acid, a deterioration in flavour might be expected when four months old.
2 B...	40½	28½	18½	87½	Caustic soda and lime.	Unclean flavour more pronounced than previously; texture open and rather inclined to shortness; colour irregular.
3 A...	41	29	19	89	Untreated	Flavour in this had considerably improved; there was still a shortness in texture, but body had improved; colour dull.
3 B...	39	28½	19	86½	Caustic soda and lime.	Unclean flavour still more pronounced than previously; texture loose and body mealy; slightly bleached in colour.
4 A...	39	28½	18	85½	Untreated	Flavour slightly improved, but insipid. The previous pronounced bad flavour had given place to a more insipid one; texture short; colour mottled.
4 B...	39	28½	18½	86	Caustic soda.. ...	Flavour improved, previous sourness disappeared to a great extent; texture short, but improved in body; colour dull.
5 A...	41½	29½	19½	90½	Untreated	Flavour fairly clean; texture and body good; colour good.
5 B...	39	28	18½	85½	Caustic soda.. ...	Previous sour flavour developed more into uncleanness; texture short; colour dull.
6 ...	39	28	19	86	Magnesia in milk and lime-water in whey.	Unclean flavour; short texture, body dry; colour dull.
7 A...	40	29	18½	87½	Caustic soda in milk, lime-water in whey.	Flavour slightly improved. In this instance the shortness in texture had disappeared and improved in body; colour was also slightly better.
7 B...	41	29½	19½	90	Caustic soda in milk, lime-water in whey.	Flavour considerably improved, showing only a slight uncleanness; texture was also close and body firm; colour, which was previously bleached, was now clear.
7 C ...	38	28	18½	84½	Caustic soda in milk, lime-water in whey.	Unclean flavour; body dry; colour bleached.
7 D...	36	29½	19½	85	Caustic soda in milk and whey.	Flavour in this case was very fruity; texture was slightly open, but body firm; colour clear.
8 ...	39	29	19	87	Caustic soda in milk, lime-water in whey, milk pasteurised.	Unclean flavour; texture close, body greatly improved with keeping; colour rather dull.
9 ...	40	29	19	88	Caustic soda in milk pasteurised, lime water in whey.	Unclean flavour; short texture; colour dull.
10 A	44	29½	20	93½	Caustic soda in milk, and pasteurised.	Clean flavour; very slightly open, breaks well, with splendid body; colour excellent.

POINTS allotted in Final Judging—*continued.*

Lot.	Flavour.	Texture.	Condition.	Total.	Method under which Milk was treated.	Remarks.
10 B	38	28½	18½	85	Caustic soda in milk, and pasteurised.	Flavour sweet, unclean; texture short; colour dull.
10 C	41½	29½	19½	90½	Caustic soda in milk and pasteurised.	Flavour fairly clean; slightly open texture, but good body; colour slightly dull.
10 D	42½	29	19	90½	Caustic soda in milk and pasteurised.	Flavour clean; slightly open in texture; colour irregular.
10 E	44½	29½	20	94	Caustic soda in milk and pasteurised.	Bright, clean flavour; texture and body almost perfect; colour perfect.

The above final grading-marks show but slight alteration in the total points awarded in most instances. Comparing the points with those allotted at the first judging, among the lots specially to be noted are 1 E and 2 A, treated with magnesia and untreated in milk respectively, both of which declined in flavour. No. 3 A, also untreated, improved to the extent of 2 points, whereas No. 2 A went back 2 points. In the case of the latter lot, caustic soda was added to the whey to reduce acid; a similar test was made in Lot 7 D, which also deteriorated from 91 to 85 points. The flavour, particularly in No. 7 D, was the main point affected; whether this defect is due to the extra addition of caustic soda or to a biological change cannot be determined. No. 4 A, an untreated lot, improved in flavour. Lots 7 A and 7 B jumped from 84½ and 84 points at the first judging to 87½ and 90 points respectively. The treatment in both cases was caustic soda in milk and lime water in whey; the alteration in texture and body was very noticeable. Nos. 6 and 7 D went back from 87½ and 91 points to 86 and 85 points respectively. Lots 8 to 10 E all showed improvement in maximum points, except 10 B, in which calcium chloride ($CaCl_2$) was used.

STARVATION IN THE HIVE.

THE following is extracted from the letter of a Tablelands farmer, who reported serious losses among his bees :—"Sunday week I noticed one colony was weak with quite a few handfuls of dead bees in the bottom of the hive, and last Sunday I was surprised to find that two colonies were completely dead in the bottom and some dead in the cells. All the brood were more or less half sealed. There were signs of the queen laying to the last day, as some cells showed very little dried-up matter."

Mr. W. A. Goodacre, Senior Apiary Inspector, replied thus :—"I consider the losses mentioned were caused by starvation. The dead bees piled up on the bottom board inside the hive, others dead in the cells, and no honey in the hive, are all clear indications of starvation. The bees may have had some honey stored earlier, but in the endeavour to raise brood all the stores were consumed. The inactivity of the bees mentioned would be proof of the absolute dearth of nectar from the field; bees will not work to any extent when there is nothing for them to gather. From perusal of the letter I do not consider that disease was present.

"When bees become inactive and sluggish in the spring, especially if the colonies are fairly populous, careful note of the stores of honey is necessary, and in no case should the colony be left short. The spring being a natural period for brood-raising, a good quantity of stores is required. If there is a dearth of nectar from the fields, and bees are short of stores, they will often quickly use the remaining quantity and then abscond or starve. Sugar and water, equal quantities by volume, stirred and fed warm inside the hive, is excellent food, or in some cases, if other colonies have ample supply, the stores can be equalised."

The Tick Bean

(*Vicia faba*).

A Green Manure Crop for Irrigation Areas.

A. N. SHEPHERD, Assistant Inspector of Agriculture.

It may be said that taken as a whole the soils of the Murrumbidgee Irrigation Areas are very deficient in humus content. To remedy this one has either to add vegetable matter in the form of farm-yard manure—which on large areas is not practicable, except perhaps in isolated cases—or by the ploughing under of crops grown specially for the purpose. The latter is being done at the present time on limited areas, various crops being used for the purpose.

The chief requirements of such a crop are, firstly, that it shall be sufficiently grown to be ploughed under in the early part of the winter, so as to allow of complete rotting before the irrigating and cultivating season—in other words, early enough to prevent the vegetable matter thus added being burnt out of the soil by the excessive heat of summer. Secondly, such a crop must produce an abundance of growth, enabling a large bulk of vegetable matter to be returned to the soil. Thirdly, a leguminous crop must be used, if possible, in order that nitrogen taken from the air may be added to the soil.

During last season the growing of Tick beans has been very successfully carried out on Mr. J. Hetherington's farm at Leeton. They were sown on 10th March in a red, sandy loam, through an ordinary wheat drill, in rows 7 inches apart, at the rate of 1 bushel per acre. Superphosphate was used at the rate of 1 cwt. per acre. Owing to the very dry season the beans were regularly irrigated every fortnight until the end of May, from which time good rains were recorded. Very heavy growth resulted, the crop attaining a height of from 5 feet to 6 feet, as can be seen from the accompanying illustrations. It was also noted that the beans stooled very well.

These beans should be especially useful as a green manuring crop on the Irrigation Areas, as they respond so readily and abundantly to the water applied. It was very noticeable that where the plants did not receive an abundance of water, the growth was rather stunted.

The beans, although only shallow rooting—which may have been due to the irrigating water not making it necessary for the roots to go deep looking for moisture—produce an abundance of fine roots; in fact, at ploughing time the top 3 inches of soil was like a moss bed, so prolific were the smaller roots. A great many bacterial nodules were also noticed on the roots.

Another great advantage in the use of Tick beans as a green manuring crop is the ease with which the growth may be ploughed in. The plants

Ploughing in Tick Beans.

Notwithstanding the prolific growth, it ploughs in comparatively easily.

A Crop of Tick Beans at Leeton.

The illustration affords some idea of the weight of the crop.

being tall and straight, they can be completely covered by attaching a chain to the plough; no choking of the plough is experienced, such as is the case with field peas.

This crop was ready for ploughing under at the beginning of July, at which time the plants were flowering. To estimate the yield, a plot was taken, the plants carefully dried, and the soil very carefully removed from the roots by washing; although a few of the smaller roots may have been lost, a fairly accurate idea of the weight of the crop was obtained. This was found to be at the rate of 15 tons 12 cwt. 3 qrs. per acre.

An analysis of the complete plant by the Chemist's Branch gave the following results:—

Nitrogen	·42
Equivalent to ammonia ...	·51
Lime, as oxide	·085
Phosphoric acid	·111
As tricalcic phosphate	·242
Potash, as oxide	·54
As sulphate of potash	1·0

One ton of beans would thus supply:—

Nitrogen (as ammonia, 11·4 lb.) ...	9·3 lb.
Lime	1·9 „
Phosphoric acid	2·48 „
Potash	12·09 „

In this particular case the crop would give:—

Nitrogen	145·429 lb.
Lime	29·711 „
Phosphoric acid	38·781 „
Potash	190·057 „

It will be seen that the Tick bean compares quite favourably with other legumes, produces a very heavy crop of vegetable matter, and under irrigation, if sown early, will mature so as to allow of it being ploughed under in early or at latest mid-winter.

Stock do not take readily to Tick beans as a fodder; in fact, if there is any other feed at all available they absolutely refuse to eat it. At the same time it should be very useful as a bee plant, for it produces large quantities of flowers, and it was noted that the bees were very busy among the plants at flowering time.

The Powder Post Beetle.

The powder post beetle (*Lyctus brunneus*) is one of the most serious timber pests about Sydney at the present time. It lays its eggs in the wood before it is cut up, and the larva, hatching out afterwards and feeding in the wood, then pupates and the small brown beetle emerges. The best method of dealing with the pest is to treat the infested wood with creosote or kerosene. These oils kill the larvæ on coming in contact with them. The more oil that can be got into the wood the more successful the treatment.—W. W. Froggatt, Government Entomologist.

Chats about the Prickly Pear.

No. 8.

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.,
Government Botanist, and Director, Botanic Gardens, Sydney.

Apparatus.

Rollers.—A good deal of useful work has been done in the crushing of pear by heavy rollers, and sometimes the bruised pear is sprayed in addition. Mr. James H. Doyle, of Invermein, Scone, had much experience with pear, and he used (when I was at Scone) what he called a roller and a crusher. The roller is much the heavier and consisted of a long ironbark log. (See illustration, p. 46.) The crusher is also a roller, but of iron, and is lighter. The crusher was used direct when the pear was not over 2 feet high. When the pear was higher the roller was used. Bullock teams were used for this work.

Sprayers.—One sprayer utilises the motive power of acetylene gas, which is generated as the spraying proceeds, but there are quite a number of sprayers on the market, as every orchardist and gardener knows.

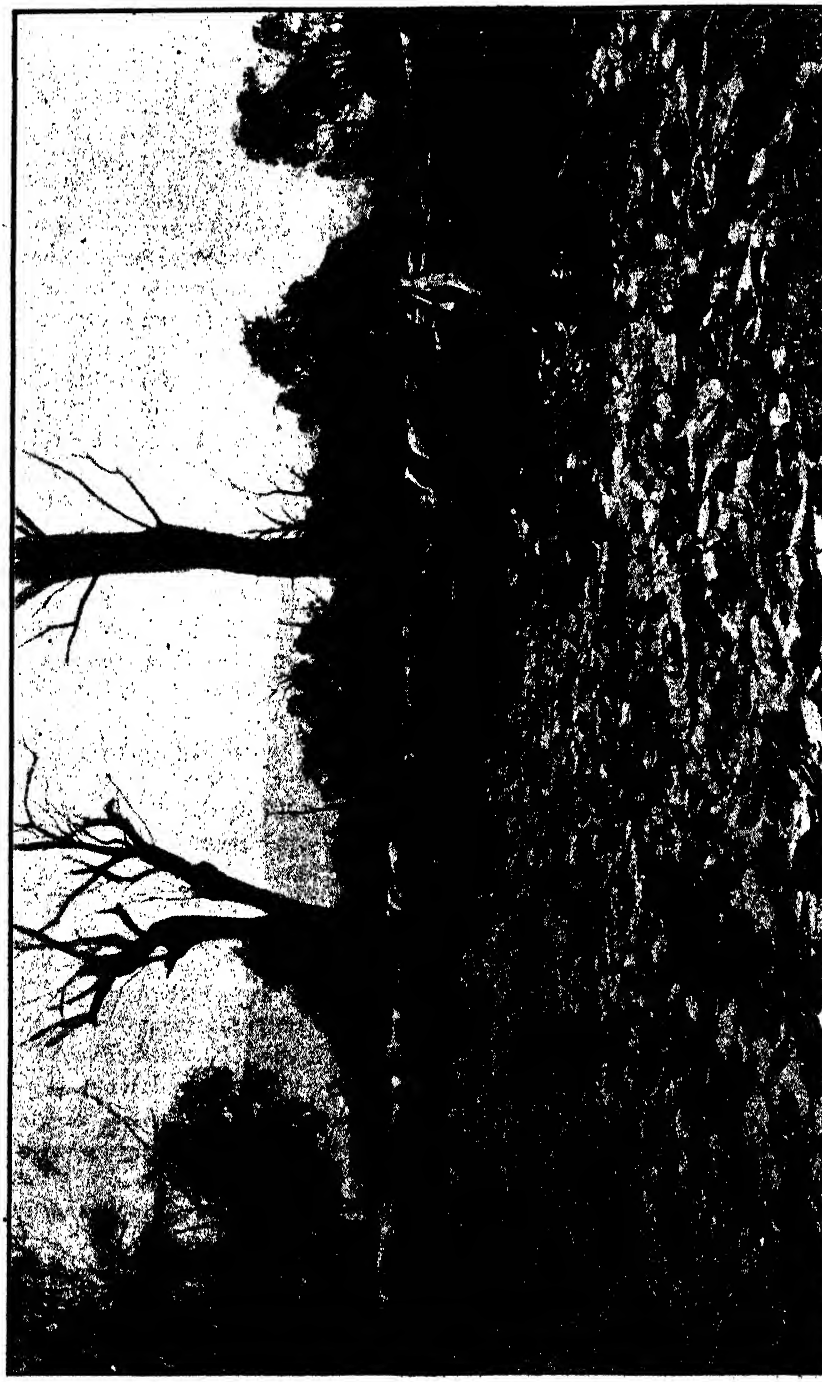
Injectors.—Then we have various injectors—for example, the well-known English appliance (often like a walking-stick, to avoid the user stooping), in which a hollow point pierces a dandelion or other weed in a lawn, and pressure on a spring releases a little of the poison, which destroys the weed. One inventor uses a deliquescent pill in his injector, which is pressed into the pear. There are various injectors of more or less merit, chiefly in use in Queensland.

My Scone Experiments of 1907–8.

The most important practical result of these experiments was that they proved that pear cannot be killed by spraying alone. It is comparatively easy to kill the fleshy "leaves" (technically called "joints") of the prickly pear, so that the plant may appear quite dead. For example, the pear on a 5-acre block was "killed" in that way. The above-ground vegetation appeared dead, and other work was proceeded with, but in the course of a few weeks the pear on this portion was almost as vigorous again as usual. Different blocks were treated with various strengths of arsenic, dissolved in a solution of caustic soda or carbonate of soda (washing soda).

Now, in a prickly pear there is what is known in common language as a "bulb." It is immediately underground, and it is nature's arrangement to enable the plant to tide over an excessively dry or difficult time—for example, injury to the joints or roots. The bulb is much like a joint in shape; the roots extend from it, and so do the joints. It is a store-house of what botanists call reserve material; it contains starchy bodies and water necessary for the continuance of the life of the plant.

The ordinary methods of spraying affect only the portion sprayed upon—that is, the above-ground portion; when trouble comes, the bulb just "lies



A Long Ironbark Log used as a Roller at Scone.

low," and in due course replaces the plant; given favourable conditions, the pear may be as bad as ever.

A number of experiments were made at Scone by wounding the bulb alone, and though this action was found to injure the vitality of the plant, it was not fatal. The implement employed was a weapon about 5 feet long, consisting of a strong wooden handle (like a rake-handle) capped with a steel point. In other words, the handle was shod with steel, and the cap was continued into a chisel-like weapon.

The method finally decided upon was to treat an area with the above weapon, and then spray the whole of the plant, taking particular care that some of the liquid ran into the wounded joint. It appeared that this should be done soon after the wounding—that is, the sprayer should soon follow the man engaged in stabbing, since nature begins at once to repair the wounds inflicted by the stabber, and to close the tissues to the free access of the poison.

When poison was applied to the wounded bulb I never knew a case of the plant failing to die. It was also found that the whole plant should be sprayed, and not the joints or leaves only. It was observed that when the bulb is injured the plant falls over and the joints lie prostrate on the ground, or at all events in most cases touch the ground in more places than before. This just suits the pear, which roots at every joint, and so multiplies the evil. But when the whole plant, wounded bulb and all, is sprayed, the whole of the plant dies. We traced the dead roots for a considerable distance, while the green portion of the plant was as dead as the proverbial cock-robin.

Having established the principle that the bulb, as well as the plant above ground, must be destroyed, the way is clear for inventors. Ingenious individuals are wanted to invent implements and devices to do this stabbing of the bulb economically. A twist of the wrist to open up the bulb is found necessary in practice. Devices for economically applying the poison to the wounded bulb are also required. I have already seen two such devices for poisoning and stabbing in one operation—an Australian one and an English one.

I am of opinion that the slashing or wounding of the joints recommended by so many experimenters with sprays is unnecessary, and therefore a waste of money.

Of course, bad pear country is impregnated with pear seed, and there is always a danger of pear re-occupying a paddock from this cause alone. If the plants are treated with a hoe as they appear, they may be destroyed without much labour.

The experiments showed that the best strength was 1 lb. commercial white arsenic and 1 lb. caustic soda, dissolved in 20 gallons of water. Caustic soda is a most acrid substance, of course, and produces severe sores on the hands, &c., of any person touching it. It is a more efficacious solvent than washing soda, but I fear that its dangerous nature will prevent most people from having anything to do with it.

On the whole, I think that an arsenical preparation is most efficacious. If, as the result of the further experiments, my view is borne out, then the official declaration of the fact will cause manufacturing chemists to fill requirements.

I do not attach so much practical importance to the bulb as I once did. I still think that the stabber should be occasionally used, with special plants, in order to make a good job.

More Recent Experiments.

Since 1910 the Department of Agriculture has supervised trials with numerous preparations, proprietary specifics, and mechanical methods of destruction suggested by officers of the Department and by others. A large amount of work has been done along this line, but with little or no success as to the great majority of the specifics and methods.

The difficulties of treating prickly pear in any manner that has a commercial recommendation have also directed attention to such other agencies as fungi, bacteria, and insects, and various trials have been conducted by the Department along these lines, without anything definite yet being reached.

A Competition Suggested.

As to the future, I would make the following unofficial suggestions for a competition in clearing infested land:—

1. Arrangements might be made for the practical test of (*a*) spraying machines and other appliances and devices for the economical distribution of liquid and solid poisons with the view to the destruction of prickly pear; (*b*) other machines, appliances, and devices for destroying pear.
2. Owners of specifics for the destruction of prickly pear might be invited to conduct experiments.

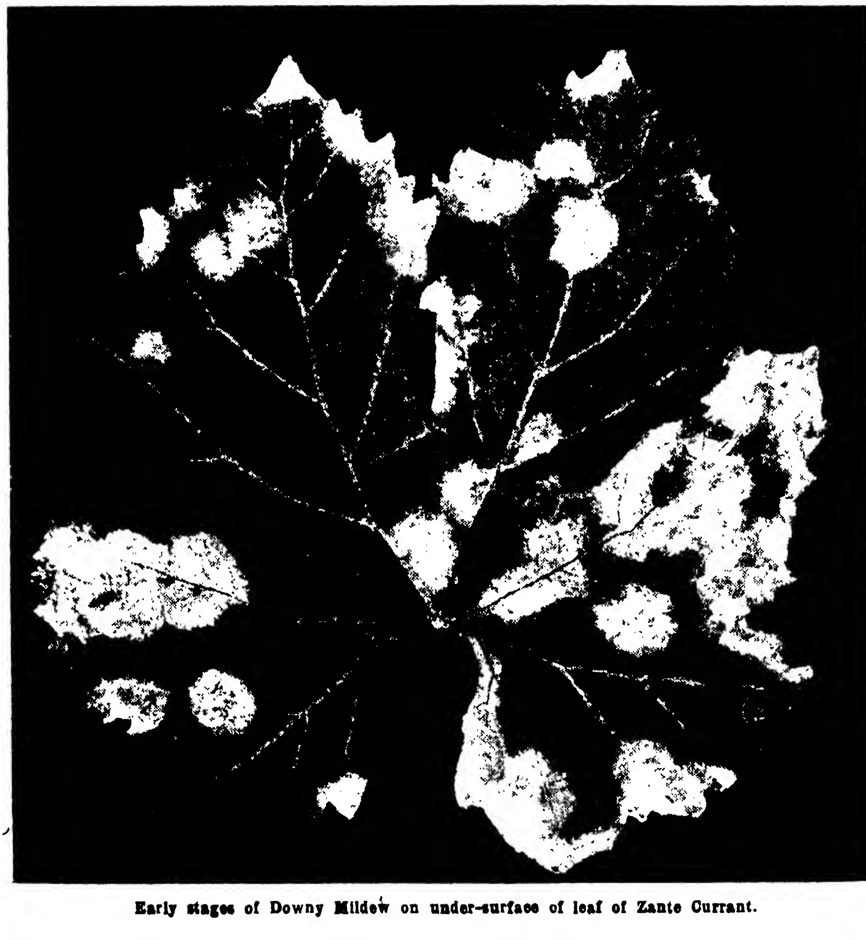
The above experiments should be free of cost to the Government, except in regard to supervision of the experiments and the application of such tests as may be necessary with the view to securing impartial comparative trials.

If there is a mechanical device or specific of special value, these experiments would probably disclose it, and the publication of a decision to that effect would immediately render the property of great value.

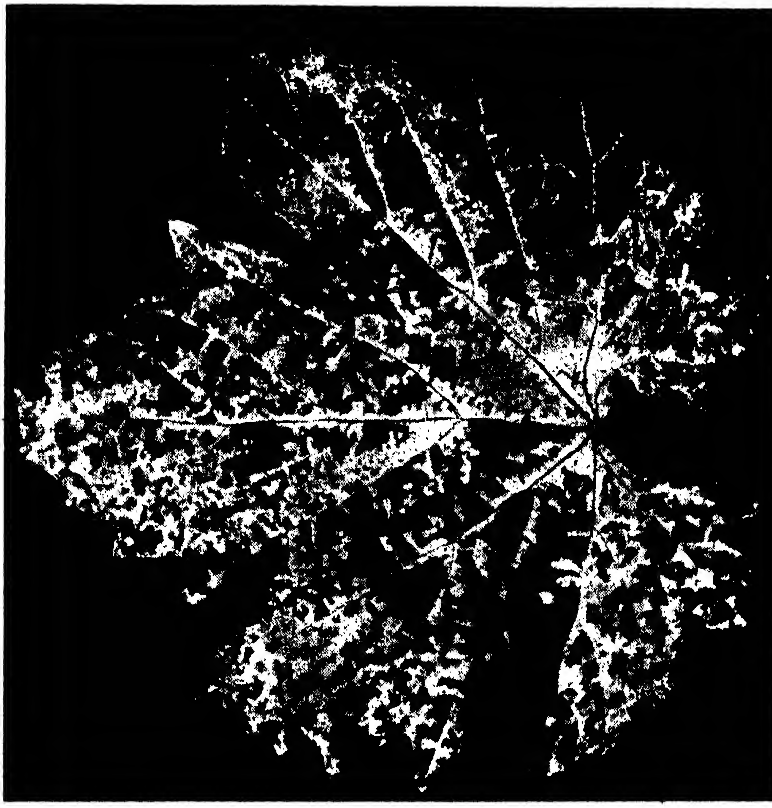
The way in which effect should be given to these suggestions would require consideration, but the problem would not be a very difficult one.

My personal experience so far leads me to the belief that some solid preparation of arsenic and soda (one containing more or less sodium arsenite) is most deadly to prickly pear. Experiments in open competition may show that some other substance (including arsenious trichloride) is more efficacious.

Cost is the keynote of all work in fighting prickly pear. Thousands of individuals know how to kill prickly pear, but the agency may be too expensive or objectionable in some other direction.

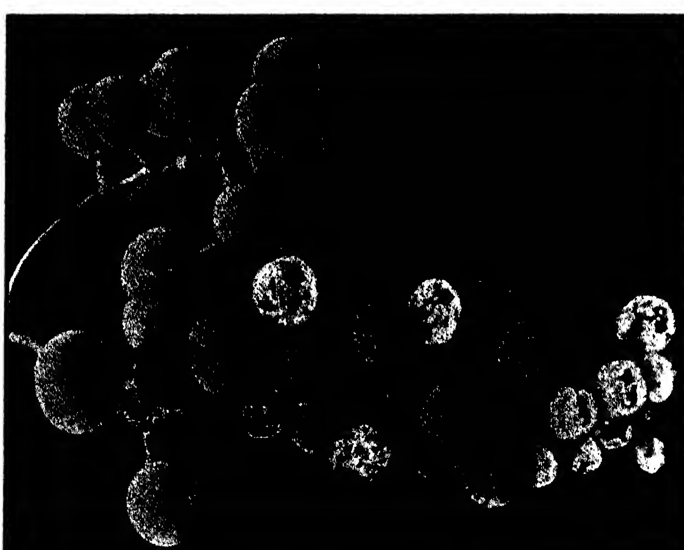


Early stages of Downy Mildew on under-surface of leaf of Zante Currant.



Under-surface of leaf of Zante Currant, badly infected with Downy Mildew.

Second crop of Spores.



Downy Mildew on Grapes.

[*After Duggar.*

Downy Mildew of the Vine.

C. O. HAMBLIN, B.Sc., B.Sc.Agr., Assistant Biologist.

Downy mildew was observed in this State at Albury in January, 1918, and in the same month its occurrence was noticed at Glenfield—much nearer to Sydney.

During the summer of last year it did a fair amount of damage around the County of Cumberland. The disease sometimes appears very early in the season, but unless it has conditions favorable to its development it makes little headway. Moisture and warmth are both essential, particularly the former. It was noted at Richmond as early as 6th October this year, but made no headway owing to the dry weather. Specimens were collected from the Murrumbidgee Irrigation Area early in November, and latest reports indicate that the damage has been very serious.

The fungus (*Plasmopara viticola*) belongs to the group of organisms which includes Irish blight of potatoes and tobacco mould.

The wintering spores, which have been hidden in dead tissue of leaves and leaf stalks lying about the vineyard, appear to carry the disease over the winter. Portions of the fungus are probably held also in the newer canes and have even been recorded in older parts of the vine.

When a leaf is infected in the growing season it gives rise on its underside to large numbers of tiny branching structures which bear the conidia or summer spores. To secure satisfactory germination and reinfection of another leaf, these spores must be able to discharge their tiny swimming zoospores into water. Thus it comes about that the fungus is most likely to spread rapidly in showery weather.

Warm moist days, such as have been frequent this season, create ideal conditions for the rapid dissemination of the spores. Once they have come to rest on the surface of a leaf, the tiny swimming spores give rise to a germ tube and, having established themselves by sending down their roots, or hyphæ, freely interpenetrate the tissues of the leaf. Once infected the leaf is able to produce continuous crops of spores. The first sign that a leaf is affected is a yellow spot on the upper surface, sometimes described as an oily spot. Soon the underside shows the greyish white patches which are really masses of spore-bearing stalks. The fungus is then ready to begin again on a new leaf centre.

This rapid production of spores in vast numbers means that, given the conditions favorable to germination, the disease will be widespread. Later on, the leaves turn brown and the tissue dies in brown patches. The fungus attacks leaves, young twigs, and fruit. In cases where the fruit is attacked early, it shrivels and does not develop but produces a crop of greyish white spore-bearing tissue as on the diseased leaves. When attacked in the late stage the fruit rots and discolours, becoming worthless. When badly damaged the leaves drop. Badly affected vines may be seriously defoliated.

Control.—Spraying has proved the most effective control, and the nature of the disease indicates it as the best method. The almost universal opinion of those who have studied the disease is that it can be readily controlled if Bordeaux mixture is used as a spray and applied in good time to anticipate an outbreak. The very first appearance of the fungus in a district, and the prevalence of showery weather should be a sign for all vignerons to commence spraying. Bordeaux mixture at summer strength (6.4.40) has proved very effective indeed. Where good lime is not obtainable Burgundy mixture should be substituted, and should be made as recommended in the Department's Bulletin on "Spraying" and used at summer strength. For small growers who are not inclined to go to the trouble of making their own Bordeaux mixture, it may be stated that some of the commercial brands of Bordeaux paste and Bordeaux powder gave effective control in experiments last season.

It is necessary to continue spraying at intervals of from ten to fourteen days, practically up to the time of ripening, to prevent the fungus from making headway. To avoid staining or injury to ripening fruit by the spray fluid, some growers in districts where the disease is prevalent use ammoniacal copper carbonate as a final spray, but this may only occasionally be necessary.

Spotted Wilt of Tomatoes.

With a view to determining the cause of this disease, the Biological Branch of the Department of Agriculture has made a careful microscopic examination of diseased plants. So far the examination has revealed no organism likely to prove causal. There are no traces of fungi.

Bacteria are, of course, almost omnipresent, but there are no indications in this disease of the presence of large numbers of bacteria, such as usually occurs in bacterial diseases of plants. Last year various bacteria were isolated, and healthy tomato plants infected, but all the results were negative, failing to produce the disease. At present, though the field indications are that the disease is infectious, the Department is unable to indicate the means of transmission, and all attempts to transmit the disease from diseased to healthy plants have so far failed.

Diseased leaves brought into contact with healthy plants have not brought about infection. The expressed juice of diseased plants when introduced into healthy plants did not give positive results.

The possibility of insect transmission has been considered. Two insects suspected (*Nezara viridula*, and the common green aphis) have been taken from diseased plants and put on healthy ones, but no transmission of the disease has been thus effected. The only lesion revealed in microscopic examination of the leaves is collapse of the epidermal or superficial layer of cells in patches. A careful examination of field data seems to discount the possibility of the disease being normally seed-transmitted.

Of various specifics recommended, none have apparently yielded satisfactory results

So far as further research goes, the Biologist is practically at a standstill for the want of suitable control houses, and a small experiment area in which to continue the work.—Chas. O. Hamblin, Assistant Biologist.

Diseases of Bees in New South Wales.

[Continued from Vol. XXXI, page 888.]

W. A. GOODACRE, Senior Apiary Inspector.

European Foul Brood (*Bacillus pluton*).

EUROPEAN foul brood has given a good deal of trouble to American bee-farmers, and in some cases is more feared than American foul brood; South African apiarists, too, have had rather a bad time with the disease, which in places has become fairly prevalent before being recognised. At present European foul brood is not prevalent in New South Wales—during the last three seasons I have not found an affected colony. The disease is a serious one, and, as in the case of American foul brood, it must be the apiarist's business to become thoroughly acquainted with its symptoms and with precautionary measures.

At first sight of a colony severely infected by European foul brood, the diseased matter would suggest itself as American foul brood, but a comparison of the symptoms of the last-mentioned disease (as described last month) with those now to be discussed will help the apiarist to distinguish a difference. In *Farmers' Bulletin* No. 975, U.S. Department of Agriculture, Dr. Phillips states that European foul brood is a disease of weak colonies; while at times one may observe larvæ dead of the disease in strong colonies, usually they are removed before the disease can do much harm. It should be pointed out, further, that it is the colony which is failing to increase in strength in the spring which is most seriously affected, for a young colony which is increasing in strength is often able to overcome the disease. It is, therefore, a disease of weak colonies rather than of small colonies.

The bee-farmer will see from the foregoing that bees under good conditions can overcome European foul brood—an important point of difference between this and American foul brood, which is never cured without treatment.

Symptoms.—As will be seen by the illustration of European foul brood published last month, the majority of infected larvæ die before being sealed. Worker, queen, or drone larvæ may become infected. Other symptoms may be enumerated as follows:—

1. The infected larvæ assume unnatural positions in the cells. (See illustration published last month.)
2. The colour of infected larvæ changes from pearly white to a slightly yellow colour, deepening until the dead larvæ become a brownish-yellow, greasy mass in various positions in the cells. (*Bulletin* 276, Ontario Department Agriculture. Illustration No. 3.)

3. Other infected larvæ in the same comb retain their curved shape, the segments and tracheæ (air tubes) being plainly visible, and the colour becoming greyish-yellow, and finally dark brown.
4. Dead larvæ are found after being sealed, but the proportion is very small when compared to the unsealed dead larvæ.
5. The diseased remains are slightly "ropy," but the ropiness is not so pronounced as in American foul brood.
6. The cappings on such cells as are sealed may be discoloured, sunken, and perforated.
7. The odour from infected brood is not of the offensive glue-pot type that characterises American foul brood in an advanced stage, but a sour smell is often evident. Odour is only one of the symptoms, however, on which the apiarist must base his diagnosis.

The disease is highly infectious, but usually disappears during a honey flow. The manner as to how infection is spread has not been clearly proved.

Precautionary and Control Measures.—As with other bee diseases, modern methods of management, use of good material, and a habit of observation may be described as preventives. Use of these and of a good vigorous strain of Italian bees is the surest way to prevent an outbreak of European foul brood. Italianising is of importance. Italian bees are, in most cases, vigorous enough to combat the disease.

Every endeavour should be made to winter colonies in good condition, so that the bees will come into spring in a vigorous state, for spring is the dangerous season so far as this disease is concerned.

Pending a definite diagnosis of any condition suspected of being European foul brood, the apiarist should observe the precautions to prevent the spread of infection recommended in the case of American foul brood.

Treatment.—Re-queen with young queens from resistant Italian stock, and endeavour to get the colonies into a populous and progressive condition. Infected weak colonies should be united so that strong colonies will result. In some cases, if nectar is being gathered and the colonies are not cleaned up, the shaking treatment (see previous article), combined with re-queening, will probably have a beneficial result. In the case of European foul brood, however, the transferred colony may be immediately assisted with a frame or two of healthy Italian brood. Neither is it necessary to destroy or disinfect any material or honey where European foul brood only is concerned.

Sac Brood.

Although the infecting agent (or germ) is so small that it cannot be detected by microscopical examination, sac brood has lately been proved to be an infectious disease. It is not a serious menace to the bee-keeping industry, for the bees are usually able to clear the diseased larvæ from the cells and free the colony from infection before much harm is done. Bee-farmers should become acquainted with the symptoms, so that the disease can be distinguished from foul brood.

Following are the points of difference between sac brood and foul brood:—

1. Dead larvæ which are stretched out in the cell in sac brood are not found in unnatural positions as in European foul brood.
2. Larvæ dead from the effects of sac brood can, if a twig or dry grass stalk is inserted carefully into the cell, be removed intact. The extracted matter resembles a tiny sack, with contents of a watery nature. In American foul brood the matter is ropy, and in European foul brood the larvæ cannot be lifted out intact, for the larval skin is too rotten.
3. In sac brood the worker bees remove the dead larvæ; there are no dried scales as in foul brood.
4. There is very little, if any, odour where sac brood is present.
5. In larvæ infected with sac brood the colour usually varies from light-yellow to brown. (The coffee-brown colour of American foul brood is not present.)
6. Both sealed and unsealed larvæ are affected in sac brood.

It is rarely found that any treatment is necessary, but if it should be noticed that the infection is sufficient to weaken a colony, then a young Italian queen from vigorous stock should be introduced. No other treatment is recommended.

Brood Dead from other Causes.

Not only disease, but certain abnormal conditions, may cause the death of brood. Brood may be affected by being (1) chilled, (2) starved, and (3) overheated.

Chilled Brood.

If bees desert a hive where brood is present, such brood will certainly chill; and in other cases where intense brood-raising goes on in the spring, a cold snap—by compelling the bees to make a more compact cluster, and thereby to leave a portion of the brood exposed—may cause some of the brood to chill. Apiarists sometimes fail to make a sufficiently careful diagnosis of a suspicious condition—sometimes with the disastrous effect that American foul brood is classed merely as chilled brood. Yet the features that distinguish these two conditions are sufficiently plain to enable any reasonably observant person to arrive at a correct conclusion. Following are some points of difference:—

1. In chilled brood the dead immature bees are in a compact sphere. In American foul brood the diseased larvæ are rarely, if ever, found in a compact sphere.
2. In chilled brood the dead inmates of the cells are usually in the pupal stage. In American foul brood the majority are in the larval stage.
3. In chilled brood the dead inmates can be removed easily from the cells, and the contents are watery. In American foul brood it is not easy to remove the diseased remains, and the contents are ropy.

4. In chilled brood the colour of the diseased remains is dark-grey. In American foul brood it is coffee-brown.
5. Any fairly vigorous colony will quickly clean up chilled brood. American foul brood cannot be cleaned up by the bees.

There is no treatment for chilled brood; the bees will clean the matter up and free the colony of the dead brood, but where bees desert a hive leaving brood to chill it is advisable—if there is any quantity of dead brood—to melt up the combs.

Starved Brood.

Where brood dies from starvation the dead larvæ are quickly removed from the cells by the bees. It may be noticed, too, that where a colony is suffering from a lack of food, the bees will uncap some of the sealed brood. Some of the immature bees may be seen in process of being removed. Their colour will be a healthy white, and they will be free of any symptom of disease.

Overheated Brood.

Overheated brood is usually caused by insufficient ventilation during very hot weather. Special attention should therefore be given to ventilation during the removal of bees. Careful note of the symptoms of chilled brood and a knowledge as to whether the colony has suffered from lack of ventilation will serve as guides for the apiarist. There is no treatment for overheated brood.

(*To be continued.*)

THE CASTRATION OF STOCK.

IN castrating horses, cattle, pigs and sheep, of any age, it is preferable to cut through all the membranes surrounding the testicle at one stroke of the knife. This will usually result in cutting into the testicular substance itself, but that is of no importance. The muscular portion of the cord is then cut with the knife if the animal is large enough to warrant it, and the vascular part cut with the emasculator or écraseur or iron and clam. In smaller animals the whole cord is cut through with the instruments named, and in very young and small animals with the knife alone.—VETERINARY OFFICERS of the Stock Branch.

"I HAVE about 7 acres of Rhodes grass, 3 acres of cocksfoot, and a few smaller lots of other grasses. Will you kindly let me know how to harvest the seed?"

The best method in the absence of special machinery is to cut and bind when the seed is beginning to shatter. Spread the dried sheaves on tarpaulin or a barn-floor and flail. Italian harvesters adopt the method of driving horses round and round the tarpaulin and treading the seed out. The seed can be cleaned with an ordinary winnower.—E. BREAKWELL, Agrostologist.

Cocoa Husks as a Fodder.

E. L. GRIFFITHS, B.Sc., Chemist's Branch.

IN European countries large quantities of cocoa husks are used as fodder, both alone and in compound feeding cakes. However, recent happenings point to the fact that cocoa husks, if fed in excessive quantities, are likely to poison stock.

In 1916 it was reported from Germany that horses had been poisoned by feeding with cocoa husks at the rate of 2¼ lb. per meal (*J.S.C.I.*, 1918, p. 240).

In 1918 several army horses died at Mans in France. These horses had been fed on cocoa husks for four days at the rate of 1½ kilos (approximately 3 lb. 5 oz.) per horse per day. Their deaths were shown to be due to theobromine poisoning, and the investigators concluded—

(*a*) That cocoa husks were poisonous to horses, and

(*b*) That the sale of these husks should be regulated.

The cocoa husks contained 0·88 and 0·96 per cent. total alkaloids (*Annales de Falsifications,* 1919, p. 282).

G. H. Hansen (Experiment Station Record, U.S.A., 38·477, 1918) says of cocoa cake:—"It is to be noted that cocoa cake contains an amount of theobromine approximately equal chemically and pharmocologically to the caffeine content of coffee and tea. Laboratory experiments both with cocoa cake and theobromine on fowls, rabbits, and mice, led to the conclusion that, owing to its poisonous character, cocoa cake should not be used as a cattle food."

From feeding experiments on dairy cows carried out at Copenhagen, A. V. Lund (*C.A.*, 1919, 350) concludes that cocoa cake should be considered "rather as a poison than a fodder."

Mitscherlich (*Annales de Falsifications,* 1919, p. 282), administered 1 grm. theobromine to a pigeon, and the bird died in twenty-four hours. The same weight of alkaloid killed a rabbit in twenty hours.

The maximum dose for human beings (B.P.) is from 5 to 10 grains in the case of theobromine.

In veterinary practice caffeine citrate is recommended by W. S. Devoe, Gould's Medical Dictionary, in the following doses:—

Pig and sheep	IV to VII grains
Dog	I to VI ,,
Horse	XV to XXX ,,

Analyses have shown a high percentage of oil of albumenoids, and a fairly concentrated nutritious food. The husks, however, contain an alkaloid (theobromine), consequently their use is not to be recommended

until further investigation is made. This investigation is now in hand. Reports from French sources indicate that poisoning may result from the use of cocoa husks, and a local poultry breeder has lost a number of ducks which were fed on a mash made with bran and cocoa husks.

The following are analyses of samples of husks and meal made recently in the laboratory of the Department, together with notes on their feeding-values:—

COCOA HUSKS (UNGROUND).

Moisture ...	11·98	per cent.
Ash ...	8·22	,,
Ether extract ..	4·40	,,
Albumenoids ...	16·93	,,
Fibre ..	12·47	,,
Carbohydrates ...	46·00	,,
	100·00	,,
Nutritive value ...	72·83	
Albumenoid ratio ...	1 to 3·2	

COCOA MEAL.

Moisture ...	10·13	per cent.
Ash ...	8·34	,,
Ether extract ...	5 46	,,
Albumenoids ...	19·50	,,
Fibre ...	13·89	,,
Carbohydrates ...	42·68	,,
Nutritive value ...	74·5	
Albumenoid ratio ...	1 to 2·8	

This is a concentrated food, and is used for feeding in other countries. The use of this food is not to be recommended, except in small quantities. Large quantities are to be avoided. It is, of course, quite a different substance from coconut oilcake, which is non-injurious.

Other analyses of cocoa meal have also been made, and have given similar results.

One analysis showed that the total alkaloids (theobromine and caffeine) present amounted to 1·2 per cent.

In one case some of this meal had been used in a mash for ducks, and heavy mortality ensued, as many as thirty to forty birds dying in a night.

PRESERVING FRENCH OR LIMA BEANS.

To every 5 lb. of beans, after stringing and slicing, add ½ lb. sugar and 4 oz. salt. Place in cooking vessel, and cover with boiling water; boil for 25 minutes, place in jars while hot, fix rubbers, screw on tops, and place jars in warm water, covering to the tops. Bring to the boil and boil for 5 minutes; remove, screw down caps firmly, and cool off. Before using, the beans may be washed in warm water.

A little carbonate of soda added to the beans with salt and sugar allows them to retain a bright colour.—W. J. ALLEN.

Safeguarding Farm Stock from Disease.

(4) By the Use of Vaccines, Drugs, and Licks.

MAX HENRY, M.R.C.V.S., B.V.Sc.

Vaccines, &c.

For many years past veterinarians have made increasing use of vaccines and sera in the diagnosis, treatment, and prevention of disease. This work will without doubt, greatly increase in the future, particularly since in this country, for economic reasons, much greater efforts than in the past will be made to safeguard our live stock by every means in the veterinarian's power. Stockowners in Australia are well acquainted with the excellent preventive results obtained by the use of anthrax vaccine and what is known as pleuro-pneumonia virus, and they have also the knowledge that other diseases may be dealt with in the same manner. One unfortunate result of the popularity of vaccine treatment has been to encourage the belief that vaccines may be applied to almost any disease, irrespective of its cause and origin, and another is that unscrupulous persons have advertised various products of this nature in such a way as to hold out entirely false ideas of their power, and have even gone to the length of placing on the market so-called vaccines which are not biological products at all, and have no right to be so labelled. Such facts as these, however, should not deter us from making the fullest use of the preventive and remedial powers of many genuine vaccines and sera.

Vaccination against anthrax has provéd its value, and the first step to be taken in an outbreak should be to arrange for the vaccination of all contact animals of any species. The same procedure should be adopted in the case of pleuro-pneumonia contagiosa of cattle, though in this disease only cattle are inoculated, since it does not affect other stock. In the latter instance great care must be taken that the virus used comes from a beast not affected with other diseases, and that it has been taken in a proper and cleanly fashion. Much of the loss of tails, and even of the mortality which at times has followed inoculation for pleuro-pneumonia, has been due to the use of dirty virus. Black-leg has in many parts of the world been controlled to a greater or less extent by the use of vaccines, and so has swine fever. With regard to some vaccines, and particularly that for the disease last-mentioned, it must be borne in mind that their use may create fresh centres of disease—hence they are not safe to apply generally; under certain circumstances they are strongly counter-indicated. None of the vaccines already mentioned are of any value as curatives, nor are most of those dealing with infectious diseases. Animals already attacked by the disease will usually succumb after vaccination.

In addition to these epizootic diseases, many outbreaks of pneumonia and other complaints of stock can be dealt with by vaccines made from organisms

concerned in the particular outbreak, and there is here a wide outlook for research and preventive work, could the veterinarian attending the cases work in conjunction with the veterinary pathologist. No doubt in the future this method will be adopted here as it has been in other countries. Such particular vaccines are by no means to be employed generally, and in the hands of unskilled and untrained men will do far more harm than good. They are of no value except in cases due to the particular organism from which the vaccine has been made.

The serum most in use is that applied against tetanus, and although at present its employment is practically confined to preventing cases in the horse, there is no reason why some of the serious sheep losses which occur after shearing should not be minimised by injections of anti-tetanic serum. Even if it is not worth while to treat flock sheep it should certainly be so with regard to stud animals.

Another group of biological products which have been of great value in the prevention of the spread of disease is represented by tuberculin and mallein. The former is widely used in the diagnosis of tuberculosis in cattle and by revealing early cases enables them to be dealt with, so preventing the infection of healthy stock. In the same way the horse stock of this country is protected from glanders by using mallein to test all horses brought into the country.

There is no reason why the use of these materials should not be extended to the enormous benefit of the stockowners of this State, and the fact that so little is used is evidence of the backward condition of this country in the application of veterinary science.

Drugs.

Of all the genuine methods which have as their object the prevention of disease, the administration of drugs, is, widely speaking, of least value. In one respect, that of preventing infection with wounds, they certainly have their place. Tetanus, blood-poisoning of various kinds, and other infections can be prevented largely by washing and cleansing wounds with proper disinfectants, though even in this case the cleansing is probably the most important factor. Disinfectants used at too great a strength may do more harm than good by killing the tissues to which they are applied.

The giving of purgatives and laxatives to healthy animals, with a view to keeping them in good health, is widely practised, and in most cases might just as well, or better, be left undone. It may at times be desirable to provide some laxative drug to stock on very dry feed, but if there is a possible choice between supplying laxative food and using a drug, the former should always be availed of.

Licks.

Licks are often used as a basis for giving drugs to large numbers of animals at a minimum expenditure of time and trouble. During recent years their employment has very greatly increased, and some rather staggering claims have been made as to their power to prevent disease. At times these claims are such as would hardly bear investigation.

The basis of most licks is common salt, and with this is given variable quantities of some common drugs. The value of licks in preventing disease is largely due to the fact that the salt eaten encourages appetite and probably aids in digestion. If Epsom salts is mixed with it the lick becomes of value in preventing constipation and may be so employed if laxative food is not available. Bone meal is of considerable value for stock in poor coastal country and other areas where lime and phosphates are not available in sufficient quantity from the soil, and despite statements which have been made to the contrary, there is no danger in its use, where the meal is properly prepared from the bones of healthy stock.

Sulphate of iron may be employed as a mild tonic and to counteract excessive succulence in the food, but being itself constipating, is not so suitable with very dry food. Other drugs are also employed, but usually in minute quantities.

In no case, however, can a lick properly replace good food, unless it itself contains a large proportion of such food, and in that case one might equally as well administer the food. Good food will do more to prevent loss from disease than all the licks put together. It appears to be a fairly wide-spread idea that a lick can be manufactured which will be of value under all and any conditions. As a matter of fact, the surrounding circumstances must be taken into consideration and a lick which would be of value during drought periods might be unsuitable during a flush season, while one suitable on the coast might not be so in the west. Finally, it is no good wasting money by giving drugs in the form of licks if the animals do not require them.

When Sudan Grass can be Cut.

Although the stage of greatest bulk and highest feeding value in the case of Sudan grass is when the plant is flowering, it is sometimes advisable to cut it earlier in order to ensure another full growth for hay or seed before winter. Sudan grass can be cut as soon as the head appears, for Sudan hay cut at this stage is not open to the objection, which obtains in the case of wheaten or oaten hay, that it has a scouring effect when cut earlier than the flowering period.—A. H. E. McDonald, Chief Inspector of Agriculture.

If the pig-keeper is to be successful in days of superfined tastes, he must systematise his industry through and through. The methods of pork production practised by our fathers are now of no avail, for there have been greater and more far-reaching changes in the public taste within the past twenty or thirty years than most of us will be ready, off hand, to admit; but it is just our ability to recognise such changes, and to alter our methods accordingly that lie at the basis of successful pig-feeding.—*Irish Farmers' Gazette.*

PURE-SEED GROWERS RECOMMENDED BY THE DEPARTMENT.

THE Department of Agriculture now publishes monthly in the *Agricultural Gazette*, a list of growers of pure seed of good quality of wheat, oats, maize, sorghum, Sudan grass, potatoes, and other crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

This list is compiled after inspection of the seed and report by a field officer of the Department (preferably during the growth of the crop), and farmers who have pure high-class seed of good quality of any variety of farm crop are therefore invited to communicate with the Under Secretary and Director, Department of Agriculture, Sydney.

The Department does not undertake to buy any of the seed, but recommends the grower by publishing his name in this list. The following list indicates where pure seed, recommended by the Department, is at present obtainable :—

Grain Sorghums :—	
Feterita	W. W. Hosking, Farm 778, Leeton.
Sweet or Saccharine Sorghums :—	
Saccaline	Manager, Experiment Farm, Lismore.
Wheat :—	
Bomen	H. M. Hall and Sons, Studbrook, Cunningar.
Canberra	R. J. O. Berryman, Botfield's Siding, *via* Bogan Gate. H. M. Hall and Sons, Studbrook, Cunningar. Taylor, Lloyd and Co., Adavale, Parkes.
Clarendon	J. Parslow, Collie road, Gilgandra.
Cleveland	W. Burns, Goongawarrie, Carcoar.
Currawa	J. Parslow, Collie road, Gilgandra.
Federation	H. M. Hall and Sons, Studbrook, Cunningar. J. Parslow, Collie-road, Gilgandra.
Firbank	J. Parslow, Collie-road, Gilgandra.
Florence	Manager, Experiment Farm, Trangie. J. Parslow, Collie-road, Gilgandra.
Hard Federation	J. Parslow, Collie-road, Gilgandra.
Penny	W. A. Graham, Rippingham Grange, Barellan.
Rymer	W. A. Graham, Rippingham Grange, Barellan. Taylor, Lloyd and Co., Adavale, Parkes.
Steinwedel	Taylor, Lloyd and Co., Adavale, Parkes.
Warren	Manager, Experiment Farm, Trangie.
Viking	Taylor, Lloyd and Co., Adavale, Parkes.
Yandilla King	H. M. Hall and Sons, Studbrook, Cunningar. W. R. Forsyth, Braeside, Wallendbeen.
Oats :—	
Guyra	A. J. Bassett, Carella, Nyrang Ck., *via* Canowindra.
Sunrise	R. C. Hopkins, Errowanbang, Carcoar. N. S. Meek, Hobby's Yards.
Grasses :—	
Paspalum	Manager, Experiment Farm, Lismore.
Sudan Grass	W. W. Hosking, Farm 778, Leeton. Department of Agriculture, Sydney.
Elephant Grass (roots or cuttings)	Principal, Hawkesbury A. College, Richmond Manager, Experiment Farm, Grafton. Manager, Experiment Farm, Lismore. Manager, Experiment Farm, Yanco.
Kikuyu Grass (roots)	Principal, Hawkesbury A. College, Richmond.
Clovers :—	
Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
Bokhara or Sweet Clover ...	A. Sommerlad, Hillcrest, Tenterfield.

It is especially desired at the present time to locate reliable sources of seed of Thew, Huguenot, Firbank, and Florence wheats, Sunrise, Ruakura, and Guyra oats, and Cape and Skinless barleys, the demand for seed of which for coastal green fodder far exceeds the visible supply.

Poultry Notes.

January.

JAMES HADLINGTON, Poultry Expert.

LOOKING back over the year just closed, it may be said that it has been one of anxiety for the poultry-farmer, not perhaps in so much as to what has actually happened, as to what appeared in prospect at the beginning of the year. Poultry foods soared in price to heights unprecedented since poultry-farming in this State has attained the status of an industry. The inevitable consequences have followed, and many small farmers have gone out of the business, while, except for returned soldiers' settlements, there have been but few accessions.

Thus has the high price of food resulted in higher prices for poultry products. True, some export trade in eggs has assisted to keep up the price of eggs, but it has not been the sole factor. Viewing the present position as a whole, the outlook for poultry-farmers was never better than at present. Let the farmer figure this out however he will, on present prices for poultry products and cost of feeding, and he must come to that conclusion. Whatever the troubles and difficulties of the past, the levelling up process has now taken place, and high prices for eggs and poultry seem assured for the next two or three years. In short, the industry has reached a stage when only low prices of foodstuffs extending over a couple of years, or a very marked decline in the consumption of eggs, can materially affect the prospects from that point of view. It amounts to this then, that nothing short of disaster in regard to our grain food supply is likely to mar the good prospects ahead for the poultry industry.

Watch the Chickens Grow.

Adverting to the lessons to be learnt during the rearing season, as mentioned in last month's notes, it will be a profitable experience for the novice poultry-farmer to note the check to growth that occurs in young stock during this and next month ; also to study closely the different class of development occurring in stock hatched in the different months, from June onwards. Observation of these points will do much to dispel some of the illusions under which poultry-keepers labour in regard to the best months in which to hatch their chickens.

Fruit and Poultry.

As the summer fruit season is now upon us, it may be well to warn poultry-farmers in regard to the effect fruit has upon poultry. It is quite a common thing to hear expressions of opinion as to how well fruit-growing and poultry-farming go together. It is not my purpose here to go into this question from a mixed-farming point of view, but from a poultry-feeding standpoint.

It appears not to be generally known that too much fruit has a most injurious effect on poultry. Probably this is not so noticeable where poultry have a free range on an orchard and its surroundings, and where their owner runs them more or less as a side line, but the most disastrous effects are felt where birds are penned, and the waste fruit is fed to them in any large quantity, mostly with a view to saving the food bill.

The effect of fruit fed to poultry is so insidious that it is rarely noticed until the damage has been done. For instance, little or no enteritis might be in evidence, or no very pronounced symptoms of illness appear, hence it is that the trouble that occurs is not set down to the true cause sufficiently early to avert trouble.

When hens are fed fruit in any large quantity a falling off in laying is one of the first indications of trouble, but this is generally put down to some other cause, while the true explanation is not even thought of, the farmer being under the impression that if fruit is good for men and women it must be equally so for poultry. However, this feeding of fruit has cost many poultry-farmers dearly in loss of eggs alone.

Nor is this all. When fruit is fed to growing stock it is equally disastrous, for they fail to grow and put on flesh; in fact, they become so attenuated that many deaths often occur as a result. The probable causes of the trouble are two-fold: first, the acid contained in the fruit, and second, the fact that fruit contains little nourishment.

It follows, then, that even from an economy point of view the practice of feeding fruit is unsound, and from a production and growth aspect it is not advisable.

A Plea for Maize.

At the present time, by far the cheapest grain for poultry is maize. And while it is not contended that this grain should be fed exclusively, it is contended that up to half maize could be fed for the evening grain feed to advantage. In addition to the economy side of the question, in the light of combined scientific knowledge and practical experience it is about time poultry-farmers scrapped this old-time prejudice against maize as a poultry food. The idea that a fair proportion of this grain fed to poultry is too heating, and that it will make them too fat, is unsound. True, if the evening feed of wheat is suddenly changed to one of maize the laying hens will most likely fall off in production, but the cause of that is the change of food and not that the hens would not (if used to it) lay just as well on maize.

As a matter of fact, if the writer—while holding that mixed grain is much preferable to either wheat or maize by themselves—was by circumstances forced to feed on one grain only, and had the choice between wheat and maize, he would prefer the latter. This contention is based upon experience and supported by observation. Again, the food value of maize, weight for weight, is superior to that of wheat. Of the protein in maize 84 per cent. is digestible, while but 76 per cent. of that in wheat is so. The nutritive value of wheat is 83·5, while that of maize is 89, and this

is not all that makes a proportion of maize in the ration of poultry desirable. It is well known that the colour of the yolk of the eggs is largely influenced by the food, and that the yolk of maize-fed hens' eggs is very much higher in colour and richer than of those laid by wheat-fed hens.

What makes Sydney eggs, apart from freshness, more sought after by buyers than those from another State where wheat is fed almost exclusively, is that the yolks are a richer quality, which make them more valuable even for pastry cooks. Ask any Sussex-street agents who handle large quantities of eggs, and this fact will be attested to.

To come to matters of experience within the ken of all poultry-farmers of this State, is it not a fact that the highest tallies made in our Hawkesbury Agricultural College egg-laying competition have been made during the last few years, while receiving a portion of maize? It is not claimed that the improvement is due to the maize, but the figures point to the fact that hens fed on a proportion of maize more than hold their own. One-third of the evening grain feed at the College is cracked maize all the year round.

In regard to the question whether maize is best fed whole or cracked, the latter is much preferable, and particularly for hens in confinement. Adult birds run on free range appear to do fairly well on whole maize, but for all growing stock it should be cracked. The value of maize for this class of stock should be recognised by all farmers.

Experiments with Tomatoes.

A recent bulletin issued by the Kentucky (U.S.) Experiment Station gives a summary of results from experiments carried out with tomatoes to determine the effect of various methods of pruning and staking on the yield, earliness of ripening and size of the individual fruits. From the results of three seasons' work, the author found that pot-grown plants were much more productive than flat-grown plants. Staking and pruning reduced the yield of marketable fruit per plant, but increased the yield per acre because of the greater number of plants that it was possible to set. Generally speaking, the yield per plant was in direct proportion to the number of bearing stems. On the whole, pruning to two stems gave the best results.

Pruning increased the size of the individual fruits, and pruned and staked tomatoes ripened approximately one week earlier than those that had been untrained. Plants trained to two stems, set 2 feet x 4 feet apart, yielded less per plant but much more per acre than similar plants set 4½ x 5 feet apart and also more per acre than untrained plants set 4½ x 5 feet. A range in length of stake from 4 feet 2 inches to 5 feet 6 inches had little effect on the total yields.

The writer concludes that it does not pay to stake and prune tomatoes for the canning factory, although it may pay in the home garden or in very intensive trucking areas. The cost of stakes, the additional labour involved, and the greater number of plants required may be the limiting factors for profitable staking and pruning.

Orchard Notes.

JANUARY.

W. J. ALLEN and W. le GAY BRERETON.

Cultivation.

THE copious rains that have fallen during December will have caused solidifying of the soil and much weed growth in many localities. For this reason it will be necessary again to get the ground into good loose condition, and to kill the weeds as soon as possible, so that if a dry spell should set in the fruit which ripens later will not suffer, and so that, in any case, the trees will have every opportunity to complete the formation of well-filled fruit buds for the following year. In some cases the weeds may have got too far advanced to be dealt with by the cultivator, and it will be necessary to use the plough. In the lighter soils, a light multiple plough can be used which allows the work to be put through expeditiously. It will also be necessary to use hoes around the butts of the trees to deal with the weeds that cannot be reached by the plough or cultivator.

After so much rain, one is liable to think the land will never dry out again, and to neglect the cultivator, especially in orchards where there is a lot of late fruit to handle.

Budding.

The sap should be running freely, and the present month is a good time to bud either established trees or nursery stock. Whatever variety is being worked, in all cases select wood for budding from trees that have proved reliable croppers of a good type of fruit. Established trees that were cut back at the end of last winter, or early spring, will probably have thrown more shoots than necessary for the base of the new framework, and it is advisable to bud more than will be actually required, to allow for losses by wind or other accidents. When large trees have been cut down below the crown for the purpose of budding, young wood will be thrown out during the growing period. It is also advisable to encourage young wood around the stem, in order to bring about an equal and continuous flow of sap. If it be found that the young shoots are too numerous, some of them should be cut hard back, and the remainder budded, so as to ensure in the future a well balanced tree.

Summer Thinning and Training.

Trees that are over-thick in foliage can have some of the heavier shoots removed where there are more than will be required for next season's leaders, and if this does not open up the tree sufficiently some of the lighter wood may also be removed. In districts subject to brown rot, and if the weather is wet, such treatment assists to some degree to check the disease.

Well-grown apple and pear trees that have shown tardiness in spur development might have the current season's lateral growth shortened at the end of this month. With varieties such as Rome Beauty these can be shortened right back to the cluster buds near their base, but in some varieties these buds are quite blind, and more length should be left.

Trees that have been previously re-worked should be watched, and any growths from the old stumps or stock that are retarding the growth of the grafts or buds should be checked back or removed.

Harvesting.

In the coastal districts, where chiefly early stone fruits are grown, the grower will be through the bulk of his marketing by the end of this month. The apple and pear grower of the tablelands, on the other hand, will only just be entering on the bulk of his harvest. The inland grower, who produces late stone fruits and grapes, will also have much fruit to handle.

In all cases the fruit should be picked in the early morning, before it has warmed up. In no case should it be packed while it is in a hot condition. Great care should be exercised to avoid any rough handling and consequent bruising. As the supply of fruit is likely to be heavy, extra care should be taken in the grading. If provision has not already been made for an ample supply of cases, this should be attended to.

The main drying peaches will be ready toward the end of this month. In operating on this fruit the notes given on apricot drying last month can largely be followed, but the peach should be exposed for a rather shorter time to the sulphur fumes. The sulphur causes the cut flesh to sweat and show beads of moisture, but does not fill the cup as with the apricot If it is desired to peel the peach, the fruit is put cup downwards on the tray; then, after sulphuring, the skin can be pinched off without shifting the position of the fruit. Fruit that has been picked at all under-ripe for drying will not peel in this way. Growers as a rule have not found the increased price for peeled dried peaches sufficient to pay for cost of peeling and loss of weight. Farmers' Bulletin, No. 52, "Fruit Drying," is procurable from the Government Printer, Sydney, price 10d., post free.

Pests.

If codlin moth has been at all bad, late hanging apples and pears should have an extra application of lead arsenate. It is in these late applications that soap as a spreader is especially useful, but it is essential that such a mixture should be used immediately after being mixed. Laboratory trials have shown that the addition of soap renders some of the lead arsenate soluble, which introduces a possibility of burning, but extensive field trials have not yet been attended by a single case of the kind. If soap is used as a spreader, an additional amount of arsenate of lead will be found beneficial; the additional rate should be 1 lb. per 100 gallons of water. If woolly aphis is present, a tobacco wash or a commercial tobacco extract, free from soda or any substance liable to upset the lead arsenate, may also be added as explained in these notes for October.

Every effort should be made to collect regularly and destroy by boiling or burning any infected fruit. Where citrus are badly affected and showing distress from scale, they can be fumigated or sprayed toward the end of this month, but where possible it is better to delay this work until later, as there is then a better chance of catching more eggs after hatching.

Fumigation has for many years back proved by far the most efficient treatment for all scale insects attacking citrus trees, but where fumigation is not practicable resin soda is the best spray known by the Department for red or black olive scale. It will also kill white wax, but if only wax be present the soda spray alone (which is far easier to mix and apply than the resin soda) is sufficient. In dealing with scale on citrus the main thing is to allow as many of the eggs to hatch as possible, but not to allow those that hatch the earliest to grow too big and develop their protective covering too much. Thus at this season of the year the trees should be closely watched and action taken when it is judged necessary.

Where white louse is starting to spread up toward the main limbs it should be dealt with at once, as at this stage winter strength lime-sulphur can be used effectively without danger of it getting on the foliage. Once the louse gets out on the smaller wood carrying the foliage, it is almost impracticable to apply the lime-sulphur strong enough to kill the louse without injuring the foliage. In the latter case fumigation is the only effective treatment.

The Loganberry.

Good reports have been received this season regarding loganberries, and there are many parts, especially in the coastal areas not too far from the markets, where this fruit could receive more attention.

Though the plant is hardy and is not over particular as to the soil, moisture must be assured if good crops are to be obtained, as the fruit fails to develop during a dry spell. The fruit is also very susceptible to hot winds.

The plant is a gross feeder, and like the passion vine the best results will not be obtained unless attention is paid to manuring. Where sufficient farmyard manure is obtainable nothing better can be used, but where its use is impracticable bonedust or blood and bone give good results. The addition of a potash fertiliser might be tried, but should not be adopted until such trials for individual localities have proved beneficial.

Effects of Milk Recording in Scotland.

Among other advantages, milk recording tends to more thorough milking out of the animals, with the consequent stimulus to greater production, as owners and staffs alike where herds are regularly tested are more anxious to obtain creditable results. Interest in the cows generally is increased, and more is done in various directions to obtain the maximum milk yields.—*The Scottish Journal of Agriculture.*

Agricultural Bureau of New South Wales.

Greetings for 1921.

IT affords me pleasure to congratulate the members of the Agricultural Bureau on the enhanced interest taken in the movement during the past year. Some few new branches have been established, and there has been a manifest increase in activity and usefulness in many others. The reports of the meetings, which appear in the "Agricultural Gazette" from time to time, indicate the manifold usefulness of the institution to farmers.

The return to duty of many field officers who had been on active service has enabled the Department to take a much more real part in the work of the Bureau, and much has also been gained by the return to their homes of many young farmers who, during their absence in Europe, had had opportunities of seeing the methods adopted there—some even of attending oversea training institutions. The ultimate effect upon the agriculture of the State of this infusion of new ideas should be highly significant, and the Bureau is a most important medium for their dissemination.

The year upon which we are entering has every prospect of being a good one, and it is with the greater pleasure, therefore, that on behalf of the Minister for Agriculture and the staff of the Department I offer to all members of the Bureau seasonable greetings and the best wishes for the coming year.

George Valder

Under Secretary and
Director of Agriculture.

Sydney, 3rd January, 1921.

Agricultural Bureau of New South Wales.

SUGGESTED SUBJECTS FOR BUREAU MEETINGS.

IT sometimes happens that, owing to some inadvertence, members of branches meet without having any particular subject before them. In such a case one of the following paragraphs may provoke a useful discussion, and a brie report of the discussion will often interest other branches.

Do you practise summer cultivation of land fallowed for next wheat crop? Have you found that it conserves moisture, or is it for some other reason that you do it? Do you find it interferes with other farm work at this season of the year?

What methods have you found best for keeping seed maize free from weevil and grain moth?

What method do you adopt for classing your wool clip? How many classes do you make, and what distinctions do you observe in the work? What is your practice in branding and baling? Have you found it necessary to amend your methods in this respect in recent years; if so, why?

What has been your experience in the feeding of chickens this past spring? Did you feed on wet mash, dry mash, crushed dry cereals, or a combination, and what have been the results as to development and percentage of losses?

How often do you find it necessary to cultivate the surface soil in the orchard during the summer? In many orchards the area hand-hoed is so great as to be an expensive item. Have you tried any horse-power implement for working closer to the trees; has the result been satisfactory as to the soil, and what has been the actual saving?

REPORTS AND NOTICES FROM BRANCHES.

NOTE.—While gladly publishing in these columns the views of members of the various Branches of the Agricultural Bureau, the Department does not necessarily endorse the opinions expressed.

Auburn.

At the meeting of this branch on 13th November, Mr. Anderson, of the Lidcombe branch, delivered a lecture on flower and vegetable gardening. He dealt with methods of propagation of bulbs, cuttings of roses, vines, &c., germinating seeds, and herbaceous grafting.

Mr. Anderson was accompanied by the Chairman, Vice-chairman, and several other members of his own branch, and the evening convinced the Auburn members of the value of such exchange visits.

The branch is offering a prize, valued at 10s., for the member who introduces most members during the year, with a minimum of ten members or no prize.

The monthly exhibition of vegetables attracted an interesting collection. One member brought a cabbage so large that it had to be carried in a clothes basket, and his other exhibits included beet and pumpkins of creditable sizes. Flowers were also forward in good numbers.

Borenore.

At the monthly meeting on 3rd November, Mr. E. Breakwell, B.A., B.Sc., delivered a lantern lecture on weeds and grasses that was much appreciated by hearers.

WEEDS AND GRASSES.

The cool and long winter allowed introduced grasses to thrive better there than in most parts of the west. Good paddocks of rye grass, cocksfoot, and Kentucky blue were very noticeable in a good season. Rye grass was considerably affected by dry weather, and after a long spell it was invariably found that cocksfoot alone survived. The latter then became tussocky and coarse, and was not relished nearly as much as when it grew in a mixture. A good winter grass was much needed for the district, and *Phalaris bulbosa*, which was doing well at Orange, was mentioned as likely to be suitable. Other winter grasses that were giving good results were Tall Oat grass (*Avena elatior*) and Giant Fescue (*Festuca arundinacea.*) It was bad policy to grow grasses alone if a clover could be found to grow with them, and a strain of Perennial red clover had been found to produce good results. To this might be added the possibility of another clover known as Bokhara or Sweet clover. The latter was very much like lucerne in its early stages of growth, with a very deep root system and heavy leaf growth. It would, however, grow much more readily in certain soils than lucerne, and, owing to its heavy seeding qualities, would last and even spread in a pasture where lucerne failed to do so. A good mixture to be recommended for Borenore would be 4 lb. *Phalaris bulbosa*, 6 lb. of cocksfoot, and 5 lb. of Bokhara clover per acre. An alternative very fair mixture would be 4 lb. Chilian clover, 8 lb. of Perennial rye grass, 6 lb. cocksfoot, and 6 lb. of Giant Fescue per acre.

The value of Sudan, Elephant, and Kikuyu grasses was also mentioned, after which the lecturer proceeded to deal with the native grasses, urging judicious stocking, resting, and subdivision of paddocks as means of maintaining the most desirable grasses.

Castlereagh (via Penrith).

At a meeting on the 29th October, Principal H. W. Potts, Hawkesbury Agricultural College, delivered a lecture on the cow and her milk.

Mr. Potts dwelt on the industry as a whole, showing what possibilities there were in dairying if carried out in a scientific manner, and giving figures to show the marvellous growth of the industry during the last twenty-eight years. He indicated that the bull was half the herd, and a farmer was unwise to purchase any but a pure-bred, with a pedigree running back at least three generations on both sides to show that he came of good milk-producing stock.

White scour in calves was next touched on. Till a few years ago disease carried off at least 20 per cent. of the poddies. After explaining how thoroughly they had gone into the matter in America, eventually discovering the cause, Mr. Potts said the only cure was sunlight. All old sheds and feeding stalls must be pulled down and the calves allowed to bask in the sun all day. This had the desired effect, and during the last four years at the Hawkesbury Agricultural College not a single calf had been lost from this disease.

Many questions were put to the lecturer, and the meeting closed with a vote of thanks to Mr. Potts, who promised to come at some future date and speak on bacteriological subjects.

Coradgery.

The annual meeting was held at Mr. W. E. Tayler's residence, Adavale, on 27th October. The report and balance-sheet showed a year of useful activity. The election of officers resulted thus:—Chairman, Mr. W. E. Tayler; Vice-chairmen, Messrs. G. Tanswell and A. Milgate; Treasurer, Mr. H. N. Marriott; Hon. Secretary, Mr. J. Clatworthy.

During the afternoon Mr. J. Clatworthy, on behalf of the members of the branch, presented to Mr. Tayler a punch bowl, water jug, and fruit dish in cut glass, in recognition of his valuable services to the branch. It was largely because of his enthusiasm that the branch had managed to keep alive during the past two seasons. The whole district had benefited by the activities of the branch. The visits of Departmental

officers had wakened farmers up in connection with sheep and with wheat. A few years ago it was difficult locally to secure good seed wheat, but now from their own members they could obtain graded wheat of all the principal varieties, equal to anything grown in the Commonwealth.

Mr. G. Tanswell heartily endorsed the testimony as to the value of Mr. Tayler's work for the branch, and in acknowledging the gifts Mr. Tayler indicated his keen apprecia- of the honor done him, and attributed the success of the branch to the activities of the various secretaries.

Cordeaux-Goondarin.

A meeting of the branch was held on 30th October, when Mr. G. H. Walker read a paper entitled "Winter Crops" of which a summary follows :—

Hairy vetch was spoken of as a poor land crop, but the hay carried as much protein as bran. The flower did not stand frost well, and that must be considered when planting for seed. The crop was especially suitable for growing with cereals, such as rye and oats. Then followed results of crops on various plots.

Planting from February to April was advocated to enable the winter crops to be got off in time for a summer crop following. The only way progress could be made was to produce more and to conserve what we already have, especially in the way of stock.

At the monthly meeting, on 25th November, Mr. Cowain read a paper, of which a summary follows :—

Experiences of Spraying.

There were three essentials to success in orchard work—(1) cultivation, (2) pruning, (3) spraying. Unless the last was done thoroughly and at the correct time, the benefit of the first two would be lost. He advocated the use of miscible oils for winter and early spring for woolly aphis and San José and mussel scales. He had absolute faith in lime-sulphur solution. He had cleaned scab from Carrington and Granny Smith trees with it. The most important times for its use was (1) when the cluster buds were opening, and (2) at the petal-fall stage. At the latter spraying arsenate of lead and tobacco wash might, if necessary, be added.

Bordeaux mixture was considered equal, if not superior, to lime-sulphur. Freshly burnt lime should be used, but was not always obtainable. He worked on the formulæ of the Department of Agriculture and had had good results from them. He had proved each spray to be thoroughly effective if made and applied as directed.

Another paper on crops growing in the district was read and attentively listened to.

Cotta Walla.

The above branch met on 26th October, when Mr. A. J. Pinn, Inspector of Agriculture, lectured on potato culture.

Potato Culture.

Mr. Pinn commenced with an interesting account of potato growing as he had seen it in the Channel Islands and Great Britain. The value of selection of seed was indicated, and the remarkable improvement made in America with the crop was pointed to; the yield of one variety had been doubled in eight years by these means. Improvement by selection could be accomplished either by the tuber method (which consisted of selecting the best tubers), or by the hill method (which consisted of choosing the best hills, and planting the tubers separately each year). He preferred the second method as giving the best results. It was the invariable rule of potato-growers to plant the small tubers, for they were the more economical and gave the better germination, but they lowered the standard of the crops. The first root dug, perhaps, would have four marketable potatoes; the second root dug might have one for market, and the remainder seed size; the third root might be all seed size. The product of the best root would thus be sold, while the product of the worst root would be planted the following year. Was it any wonder the standard of varieties of potatoes degenerated?

The importance of good cultivation and of manuring was also urged. Grading was also advocated, the experience of New England growers being mentioned in this connection.

Dural.

On 26th November several subjects were very usefully discussed.

Improved Yellow Dent maize sown early for early fodder crops, and Hickory King, for good growth and milky cob, before Christmas, or when moisture was available, were regarded as useful for general sowing.

Undiluted wood oil, painted on fowl houses, had given good results as a preventive of lice, and certain miscible oils, with 50 per cent. water, had also been found effective.

Granny Smith and Cleopatra apples had been found most affected with bitter pit, and cultivation had not been observed as acting as a preventive.

Lime-sulphur spray mixture was made by a number of growers by various methods, but chiefly on the Departmental formula, and was tested for specific gravity to avoid damage to trees and also extravagance by the use of too great a strength.

Garra-Pinecliff.

The annual meeting of this branch was held at Mr. H. Robards' residence on 28th October. The secretary's report showed that the year's work had been satisfactory, considering how trying the season had been. The treasurer's balance-sheet showed that there was a useful credit balance.

The election of officers resulted thus:—Chairman, Mr. W. Forrester; Vice-chairmen, Messrs. H. Robards and S Bradley; Treasurer, Mr. S. Robards; Hon. Secretary, Mr. S. W. Packham.

It was decided to make an effort to stage an exhibit of produce grown by members at the next Molong Show.

Glenfield.

At the meeting on 16th November, Mr. A. Blinman, Chairman, read a paper on vegetable growing. He stressed early and thorough preparation of the soil, and recommended plenty of farmyard manure to be spread over the ground; blood and bone should be applied in drills when planting.

Glen Innes.

At a meeting on 4th December, a discussion took place on sorghums and millets. Mr. H. Osborne was in favour of Early Amber cane, *Sorghum saccharatum*, Hungarian millet, and Sudan grass for the district. Mr. Farlow agreed, but preferred Japanese millet to Hungarian millet on account of it being a heavier cropper, though he admitted it took longer to mature. Mr. Spatch was a believer in Early Amber cane. Mr. Morton had tried Saccaline, but the season here was too short, an experience that corresponded with that of Mr. Osborne.

Henty.

A paper was read by Mr. F. A. Schultz on incubation at the meeting of 18th September. He remarked that the hen that got away by herself and hatched her brood under a woodheap or in a haystack, always got the best results. Artificial incubation was fully dealt with, valuable suggestions being made, and several questions answered.

At a further meeting on 13th November, a discussion took place on methods of preventing diseases and pests in fruit trees.

Mannus.

At the November meeting Mr. C. Pedersen, dairy instructor, gave an interesting lecture and lantern display on dairying subjects.

The lecture indicated how a dairy herd could be improved, stress being laid on the necessity for the sire coming from a strain of proved heavy milkers—and not for one generation, but for several. The dairy farmers, too, must go in for pure strains of cows, not for crossbreds.

Herd-testing was also touched on. It was about the only way of finding out the profitable and unprofitable cows, and every dairy-farmer should adopt it.

Mittagong.

A very successful meeting was held on 9th November, when the election of officers resulted thus:—Chairman, Mr. A. E. Boswell; Vice-chairmen, Miss Barker and Mr. E. P. Furby; Hon. Secretary and Treasurer, Mr. A. Shimmels.

Mr. A. E. Boswell, orchardist at the Farm Home for Boys, Mittagong, then read a paper on insect pests, from which the following is extracted:—

It is just as essential that the orchardist and the farmer should study insect pests, their habits, and the means for the eradication, as that he should have a knowledge of the science of cultivating, pruning, spraying, &c. A study of entomology—that branch of zoology that treats of insects—will enable the intelligent orchardist or farmer to identify the various insects and distinguish between their power for evil or good. He will, moreover, be in a position to recognise any new variety, whether it be beetle, moth, spider, or grasshopper. With a knowledge of its life history, its means of propagation, methods of feeding, &c., he will be able to adopt means to combat it. Even those with an elementary knowledge of insect life are aware of the stages through which an insect generally passes, viz.:—1st, egg; 2nd, larvæ, as caterpillar, grub, or maggot; 3rd, chrysalis, after the feeding stage; 4th, perfect insect, after a period in which it has remained dormant, in the form of moth, fly or butterfly. Usually the life of the perfect insect is short, amounting sometimes to only a matter of hours, during which it does not feed but confines its attention to the perpetuation of its species by depositing eggs. Acquaintance with the various kinds of insects, acquired by practical study of them in their different manifestations, is of the greatest importance to the man on the land. The study of them cannot begin too soon, and the matter is of sufficient importance to warrant a systematic course of instruction in the primary schools.

Mr. Boswell then proceeded to deal with the codlin moth as the most conspicuous insect of the "chewing" kind.

Mullumbimby.

The members of this branch met on 27th November, when several subjects were usefully discussed.

Quakers' Hill.

At a meeting on 18th November, a discussion took place on potato-growing and varieties, being provoked by samples of different varieties brought by Mr. S. Pye to the meeting. Mr. J. J. Pye also produced some coloured maize which attracted attention, and after inspection the grain was distributed as seed. The discussion was regarded as a profitable one.

Rydal.

On 30th October Mr. A. W. Burgess read a paper on local products that was heard with interest.

SOME LOCAL AGRICULTURAL PRODUCTS.

Potatoes, peas, and turnips were three profitable crops that he found worked well together

The Potato.—For this crop he preferred granitic country. Soil of this nature, covered with bracken, although difficult to put into good order, would stand cultivation for a long period. Black flats, in comparison, were liable to cake in dry weather or hold too much moisture in wet seasons. Sandy soil became infested with sorrel and produced light crops. He favoured ploughing seven or eight inches deep, and harrowing early in winter.

As to varieties, Manhattan did well in heavy soil, but was not a good seller. Freeman usually grew very large and hollow; if planted thickly, a smaller potato would result. Early Rose and Satisfaction had given best results. Satisfaction should be planted towards the end of November, say 15 inches and 3 feet apart. By planting late they would avoid potato-fly, usually prevalent in the early part of the year. Early Rose should be planted in December, as late planting would prevent second growth, to which this variety was subject.

Mr. Burgess generally used cut seed, with two eyes on each set, and about 8 cwt. seed per acre. After planting, he harrowed the land down and again used the harrow when the plants were about four weeks old to break the crust which formed. Afterwards he used the scarifier when necessary.

He stored in a shed in preference to pitting. Small potatoes could be fed to cattle or pigs with good results if boiled.

Peas.—These did best on land that had grown a crop of potatoes. They needed good cultivation. The land should be ploughed 7 inches or 8 inches deep and harrowed, and then allowed to lie fallow through the winter. He commenced planting about the beginning of September and planted at intervals of a week or so till New Year's Day. Plough very shallow in September, as it is not wise to plant deep at that time. As the season advanced they should plant in deeper drills according to the depth of the moisture. He used 1½ bushels of seed per acre, in rows 2 feet 6 inches apart.

After the vines were about two weeks old he used a light harrow to break the surface and so keep the moisture about the plants. As they grew older he used a scarifier frequently and kept weeds cleaned out. Picking should commence as soon as pods were filled. The crop should not be packed in a heap, as they would sweat very quickly and turn white.

Yorkshire Hero, which was found the best suited to the district, grew on small vines, and was a very hardy variety. It matured in about fourteen weeks. The pods filled well, and in normal seasons produced about 150 to 200 bushels per acre. Another variety used, Stratagem, required a long season (18 weeks) to grow to maturity. This variety grew pods 5 inches long on a heavy vine. Senator, a new variety in the locality, yielded about 200 bushels per acre.

Turnips.—He had found Purple Top Swede best suited to the district. On good clean soil he sowed about 2 lb. seed per acre broadcast. If weeds were likely to appear, the seed was best sown in drills to allow room for cleaning.

The best time to sow was early in January, in damp weather. His practice was to plough and harrow the land; then plant the turnip seed on the surface and harrow in, covering very lightly.

DISCUSSION.—An interesting discussion followed respecting different varieties of potatoes and peas grown in the locality, and the suitability of certain soils.

In reply to questions, Mr. Burgess stated that turnips planted in January had yielded 7 tons per acre at £18 per ton. Taking various seasons they had averaged £70 per acre. They were also splendid cattle feed in winter.

Peas had averaged about 5s. to 6s. per bushel, though occasionally much higher, and yielded about £20 to £30 per acre. The seed cost about £3 per acre, and the cost of picking was 1s. 6d. (eighteen pence) per bushel. Loamy loose soil was desirable. Black flats were not desirable for peas in wet seasons.

Potatoes had yielded 4 to 6 tons per acre in new ground—without manure or fertiliser. He generally adopted a rotation of potatoes, peas, and oats.

DEPARTMENTAL NOTE.—The average of £70 per acre from turnips is an excellent one, but too high for average conditions.

The members met again on 27th November, when Mr. J. D. Gardiner read a paper on the sheep suitable for the Rydal district. He had found strong wool merinos best suited to the locality, preferring that type to either fine merino or any crossbred. They were more profitable and resisted disease better. He had been very successful in treating sheep affected with fluke

and worms by drenching with a mixture consisting of one desertspoonful of turpentine and two of milk. He gave three doses at intervals of two or three days. Stockholm tar added to Liverpool salt (1 pint tar to 20 lb. salt) made a very good lick.

Tingha.

The monthly meeting was held on 6th November, when arrangements were made for representatives to give evidence before the Legislative Council's Select Committee on Agriculture. A request from Guyra for co-operation in arranging a district exhibit for the next show was favourably considered.

Before the meeting closed, the Chairman, Mr. G. W. Browning, on behalf of the members, presented to Mr. M. C. Levitt a Rotherham watch as a token of appreciation of his services to the branch in the capacity of Hon. Secretary. Mr. Levitt had had to relinquish his post in consequence of ill-health, and members were very sensible of the important part he had played in the success of the branch. In addition to Mr. Browning, Messrs. Vickery, Hawkins, and other members testified to the value of Mr. Levitt's services, and trusted his recovery would be early and complete.

On 20th November, Mr. W. le G. Brereton, Assistant Fruit Expert, gave a demonstration of summer thinning at Mr. Robilliard's orchard.

Summer Thinning.

The name, summer thinning, covered a number of operations, starting in spring and continuing through the season. The earliest work was with the young trees, and was for the purpose of forcing out fresh leaders, and so getting the frame-work more quickly built up. With older trees the aim was to try to do away as much as possible with summer thinning, for this operation came at a time when the orchardist's hands were full of other work. In winter, the pruning shortened back the year's growth with a view to forcing out several strong eyes to allow a choice of leaders. The top eye generally came away the strongest, the eyes weakening lower down the stem. It was often found that when the top eye took the right direction, the next was in the wrong, while the third, though right, was not sufficiently strong to make a satisfactory leader. This was especially so in the apple and the pear. To overcome this early in spring they should rub out the second leader, and so give the third a better chance. If rubbed out during the winter the gap had a tendency to cause uneven growth, because the sap had found a difficulty in passing the gap, so that the top bud was robbed, other undesirable buds receiving the supply of sap.

Mr. Brereton proceeded to demonstrate the treatment of peach, plum, apricot, and apple trees, and gave valuable suggestions on other subjects as the condition of the trees afforded opportunity.

At a meeting on 6th December arrangements were advanced for the third annual exhibition, to be held on 18th and 19th February. A lengthy prize list has been prepared.

Toronto.

At a meeting on 2nd November, Mr. H. Filmer dealt with propagation of plants by seed. The schedule of the show, to be held on the 15th January, was circulated, and arrangements for the event were further considered.

Walla Walla.

The ordinary meeting was held on 30th October, when a discussion took place on the starling pest, correspondence from South Australia being read on the subject.

Wetherill Park.

At the meeting on 17th November, the resignation of Mr. A. J. Hodges, who has been secretary to the branch for several years, and who is now leaving the district, was received with regret, and with an expression of thanks for his valued services. Mr. C. J. Brown was elected to the vacancy.

A discussion, which proved helpful to members, took place on black spot in tomatoes.

Wentworthville.

At the meeting on 24th November, Mr. A. A. Ramsay, Principal Assistant Chemist, delivered a lecture on the preparation of the soil and manuring. Ploughing, harrowing, and cultivating were dealt with, the importance of producing a good tilth being indicated, especially if the best results were to be obtained from manuring. The essentials of plant growth were mentioned, and green manuring and the saving and use of stable manure advocated.

Windsor.

A meeting was held on 22nd November, when various business was dealt with. It was agreed to approach the Railway Commissioners on the subject of freight charges on fruit.

Yarramalong.

The annual meeting was held on 23rd November, when the following office-bearers were elected :—Chairman, Mr. J. L. Ellis ; Vice-chairman, Mr. C. Waters ; Treasurer, Mr. J. Bailey ; Hon. Secretary, Mr. E. Hodges. The balance-sheet showed a credit of £4 17s. 8d.

Yarrunga-Avoca.

At a meeting on 25th September a discussion took place on the cost of producing cabbages. One grower supplied the following from his actual experience :—

	£	s.	d.
Ploughing (three times), at £1 per acre	3	0	0
Harrowing (twice), at 5s. per acre	0	10	0
Plants, at 8s. per 1,000—7,500 per acre	3	0	0
Manure—17 cwt. blood and bone per acre, at £12 per ton	10	0	0
Labour for planting—Two men for 2½ days, at 10s. per day	2	10	0
Chipping—One man for 2 days, at 10s. per day	1	0	0
Scarifying (once)	0	10	0
Cutting and loading	5	0	0
Carting to rail, £1 per ton, 16 tons	16	0	0
Freight on rail	12	8	0
Cartage from Darling Harbour to the Markets	4	16	0
Market dues	1	4	0
	£59	18	0

The cabbages realised £175, less £13 2s. 6d. commission, so that the profit was at the rate of £101 19s. 6d. per acre.

On 30th October a very successful picnic was held by the branch, members and friends to the number of 100 journeying to Fitzroy Falls. A most enjoyable day was spent, and at lunch time, Mr. C. Wright presiding, several toasts were honoured.

Opportunity was taken by Mr. C. C. Crane, Organising Inspector, to state the advantages of membership of the Bureau, and to indicate how the Department of Agriculture serves farmers generally, and Bureau members particularly.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1921.

Society.	Secretary.		Date.
Albion Park A. and H. Association	H. R. Hobart	Jan.	14, 15
St. Ives A. and H. Association	A. K. Bowden	,,	14, 15
Gosford District A. Association	H. G. Parry	,,	21, 22
Kiama A. Society	G. A. Somerville	,,	25, 26
Nimbin A. and I. Society	W. P. Stanger	Feb.	2, 3
Wollongong A., H., and I. Association	W. J. Cochrane	,,	3, 4, 5
Cobargo A., P., and H. Society	T. Kennelly	,,	9, 10
Shoalhaven P. and A. Association (Nowra)	H. Rauch	,,	9, 10
Central Cumberland A. and H. Assoc. (Castle Hill)	H. A. Best	,,	11, 12
Ulladulla A. and H. Association (Milton)	R. F. Cork	,,	16, 17
Guyra P., A., and H. Association	P. N. Stevenson	,,	16, 17, 18
Fairfield Branch Agricultural Bureau	H. P. Godfrey	,,	17, 18
Blacktown and District A. Society	J. McMurtrie	,,	18, 19
Wyong District A. Association	E. H. Chapman	,,	18, 19
Dapto A. and H. Society	F. James	,,	18, 19
Luddenham A. and H. Society	C. C. Wallace	,,	18, 19
Bangalow A. and I. Society	W. H. Reading	,,	22, 23
Yanco Irrigation Area Agricultural Society	R. Tribe	,,	22, 23
Robertson A. and H. Association	E. S. Martin	,,	22, 23
Southern New England P. and A. Association (Uralla)	H. W. Vincent	,,	22, 23, 24
Dorrigo and Guy Fawkes A. Association	A. C. Newman	,,	23, 24
Gunning P., A., and I. Society	S. A. Beer	,,	23, 24
Newcastle A., H., and I. Association	E. J. Dann	,,	23 to 26
Hastings River A. and H. Society (Wauchope)	A. D. Suters	,,	24, 25
Nepean District A., H., and I. Society	C. H. Fulton	,,	25, 26
Tamworth P. and A. Association	J. R. Wood	Mar.	1, 2, 3
Tenterfield P., A., and M. Society	E. W. Whereat	,,	1, 2, 3
Manning River A. and H. Association (Taree)	R. N. Stow	,,	2, 3
Mirrool (M.I.A.) A. Society (Griffith)	F. A. Browne	,,	2, 3
Richmond River A., H., and P. Society (Casino)	P. M. Swanson	,,	2, 3
Tumut A. and P. Association	T. E. Wilkinson	,,	2, 3
Taralga A., P., and H. Association	J. J. Kearney	,,	2, 3
Oberon A., H., and P. Association	C. S. Chudleigh	,,	3, 4
Hunter River A. and H. Association (West Maitland)	E. H. Fountain	,,	3, 4, 5
Berrima District A., H., and I. Society (Moss Vale)	J. W. Kenny	,,	3, 4, 5
Camden A., H., and I. Society	A. E. Baldock	,,	3, 4, 5
Bellinger River A. Association	J. F. Reynolds	,,	4, 5
Mudgee A., P., H., and I. Association	E. J. Hannan	,,	8, 9, 10
Glen Innes P. and A. Society	Geo. A. Priest	,,	8, 9, 10
Moruya A. and P. Society	H. P. Jeffery	,,	9, 10
Tumbarumba and Upper Murray P. and A. Society	E. C. Cunningham	,,	9, 10
Gloucester P., A., and H. Society	F. H. Chester	,,	10, 11
Goulburn A., P., and H. Society	F. D. Hay	,,	10, 11, 12
Batlow A. Society	C. S. Gregory	,,	15, 16
Armidale and New England P., A., and H. Assocn.	A. H. McArthur	,,	15 to 18
Upper Hunter P. and A. Association	R. C. Sawkins	,,	16, 17
Gundagai P. and A. Society	H. W. Simpson	,,	16, 17
Macleay A., H., and I. Association (Kempsey)	E. Weeks	,,	16, 17, 18
Royal Agricultural Society of N.S.W.	H. M. Somer	,,	21 to 30
Upper Manning A. and H. Association (Wingham)	D. Stewart	April	13, 14
Narrabri P., A., and H. Association	C. C. Baker	,,	13, 14, 15
Orange A. and P. Association	G. W. Williams	,,	13, 14, 15
Clarence P. and A. Society (Grafton)	L. C. Lawson	,,	13 to 16
W.D.A. and H. Society (Nabiac)	G. O'Connor	,,	21, 22
Dungog P. and A. Association	W. H. Green	,,	28, 29, 30

[Subsequent fixtures are noted but held over.]

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Agricultural Gazette of New South Wales.

Farmers' Experiment Plots.

WINTER FODDER VARIETY TRIALS, 1920.

Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Assistant Inspector of Agriculture.

VARIETY trials of green fodder crops were carried out during the late winter on the above areas. The several cereals were used separately and in conjunction with vetches, the vetches being introduced not only with a view to increasing the quantity of the crop, but also its quality as a balanced ration.

The undermentioned farmers co-operated with the Department in the carrying out of the trials:—

H. H. McDonald, Farm 151, Leeton.
W. Edwards, Farm 367, Leeton.
N. McKenzie, Farm 203, Leeton.
G. John and Son, Farm 194, Griffith.

Season and Cultural Methods.

Once the drought broke in June, the season was one of the best experienced on the area, though the excessive rain rather tended to decrease than increase the yields in some cases. It is in such a season as that just experienced that settlers could and should make provision for those in which natural fodder is scarce. In most cases during the late winter dairymen had ample feed (chiefly herbage) to carry their stock, and produce big cheques for cream from the butter factory. In such a season the less careful man is apt to forget what he has just passed through—to fail to prepare for another period of scarcity. Doubtless, with an abundance of natural fodder, bigger returns can be obtained with little or no work in the way of hand-feeding, but the man who grows and conserves fodder during time of plenty is the one who comes out on top.

In all these trials sowings were carried out early in the season, and the fodders were thus available before the breaking of the drought or just before feed was plentiful.

Thorough preparation of the soil prior to sowing included irrigation, cultivation, and the throwing up of checks 1 chain apart to facilitate watering during the growing period. By the use of the narrow checks irrigation is much simplified, and less labour expended on it. At the same time much more satisfactory irrigation takes place, less water is used, while if the land is uneven or is not very well graded, there is less chance of the crop being scalded by standing water. Another advantage of the small checks is that in dry times, as soon as one check is cut out, water may be immediately applied, and the second growth comes away quickly.

After sowing, in place of ordinary harrowing, the harrows were turned upside down, a weight applied, and the whole then put over the land. By this process the land was packed—but not tightly—around the seed, with the result that a quick and even germination was obtained, and the hard surface avoided, which would have resulted from use of a roller.

The Plots.

Farm 151.—This trial was sown on rather heavy clay soil, and consisted of a variety test both separately and in conjunction with vetches. The land was ploughed in January and allowed to lie fallow; harrowed February; irrigated 14th and 15th March; double-disced and harrowed 20th and 21st March. The crop was drilled on 22nd March at the rate of—barley 1 bushel, wheat 1 bushel, and oats 1½ bushels. In the case of the mixtures 30 lb. of vetch seed were added. A dressing of 56 lb. of superphosphate was applied to the land.

Very good germination was obtained, but owing to the dry weather the crop was irrigated during the last week of April. Very prolific growth resulted in part of the plot lodging. This was especially noticeable in the case of the Sunrise oats, and it was noted that this oat was also badly affected with rust. Florence wheat was the first to mature, and was cut on 26th July. At that time, although the vetches were over 4 feet high, they were still growing, and would have produced heavier weights, but this had to be sacrificed to obtain the maximum feeding value from the wheat. This wheat could have been cut a month earlier, though the yield would not then have been so heavy.

It was obvious from the way this trial matured that by the sowing of such plots it would be possible to obtain a regular supply of fodder over a lengthy period, and at a time when it could be put to such good use that there would be no excess. No two plots were ready for cutting at the one time. Stock showed a great liking for the mixture, and more especially as the vetches matured. The yields were as follows:—

Crop.	Yield per acre.			
	t.	c.	q.	lb.
Oats and Vetches	9	19	2	0
Wheat and Vetches	9	16	0	8
Sunrise Oats	9	10	1	12
Algerian Oats	9	1	3	7
Cape Barley and Vetches	8	19	1	4
Cape Barley	8	8	3	20
Florence Wheat	8	5	0	0

Farm 367.—A variety trial with wheat, oats, and barley, and also plots with these three and vetches, was carried out here. Rates of seeding and manuring were similar to those in the other trials.

These plots made exceptional growth, Sunrise oats attaining a height of over 7 feet. This oat, although a quick grower, also has its disadvantages in that it is a poor stooler, coarse in the straw, liable to lodge, and very susceptible to rust. Hard Federation was used in this trial, and compared

very favourably with varieties such as Thew and Firbank, which have produced heavy crops in the past. Skinless barley matured quickest of those tested. Following are the yields:—

Crop.	Yield per acre.			
	t.	c.	q.	lb.
Cape Barley and Vetches	10	2	1	17
Sunrise Oats	9	17	2	0
Algerian Oats and Vetches	9	16	1	0
Cape Barley	9	15	3	14
Hard Federation and Vetches ...	9	6	3	7
Algerian Oats	9	4	1	0
Guyra	9	3	2	0
Canberra	8	17	3	0
Hard Federation	8	17	2	0
Firbank	8	16	2	7
Thew	8	15	2	14
Skinless Barley	8	15	2	0

Farm 203.—The land on which this trial was sown was rather on the heavy side, and inclined to be "crab-holey." The consequence was that the yields were reduced owing to patches scalding, following on the heavy rains.

The land was irrigated previous to ploughing in March, and after being well worked was again irrigated before sowing, which was carried out on 4th and 5th April. The previous crop had been oats for hay, which had been manured with 40 lb. of superphosphate per acre. Rates of seeding and manuring were as in the other trials.

The mixture of Cape barley and vetches did exceptionally well on this plot. The vetches attained a height of 5 feet, but owing to their upright growth and the sustaining power of the barley no trouble was experienced in harvesting. Sunrise oats gave a big bulk of fodder, but the rust trouble was again in evidence. The yields were:—

Crop.	Yield per acre.			
	t.	c.	q.	lb.
Cape Barley and Vetches	8	15	3	7
Canberra Wheat and Vetches ...	7	19	2	0
Sunrise Oats	7	19	1	0
Bomen Wheat and Vetches... ...	7	18	3	7
Guyra Oats	7	16	2	0
Cape Barley	6	18	2	0
Thew	6	14	2	7
Firbank	6	14	2	7
Canberra	6	14	2	7
Bomen	6	13	2	0

Farm 194.—This plot was sown on 17th March on red clay loam, but rather a poor germination, followed by patchy growth, resulted. The oats

gave the best growth, but, owing to the unevenness of the crop, comparative weights would have been hard to obtain, and the crop was fed off. After feeding off, fair growth resulted, the oats again coming away the best.

South Coast District.

R. N. MAKIN, Inspector of Agriculture.

DURING the winter of 1920 the following farmers co-operated with the Department in conducting experiments with green fodder crops of wheat, oats, and barley :—

J. Chittick, Kangaroo Valley.
J. H. Martin, Pambula.
L. B. Garrad, Milton.
E. G. Kelly, Bega.
Superintendent, Boys' Farm Homes, Mittagong.

The crops were sown mostly in March and April, but were later than usual in maturing, owing to an exceptionally dry winter season; indeed it was perhaps a record dry spell for some parts of the South Coast. However, the rain which fell in August in some districts helped the crops immensely, notably at Kangaroo Valley.

The main object of such crops as these is to provide green feed, chiefly for dairy stock, during July, August, and September. In most cases farmers are able to carry on with sorghum (Planter's Friend) till the end of June, and if a supply of wheat, oats, or barley is available in July, dairy stock do wonderfully well on it.

These experiment plots have proved over and over again that, in order to obtain supplies of such fodder at the time mentioned, two things must be observed, viz., the ground must be prepared early and suitable varieties must be used.

The early preparation of the ground is very important, as the soil moisture must be conserved in order to secure a satisfactory germination at the right time.

Planting from the middle of March to the middle of April is recommended, and in order that this may be carried out the ground should be ploughed in December or early in January, and again ploughed before sowing.

In regard to varieties, on the lighter soils and on the higher grounds wheat will generally do better than oats, while on the lower land and on stiffer soils oats will mostly suit best, and barley likes ground with plenty of fertility to be successful.

Of varieties of wheat, Thew, Firbank, and Florence may be safely planted. Of oats, Sunrise stands alone for early maturity and heavy yield. Ruakura is also a good early oat in some districts. Guyra in some seasons escapes rust, comes early, and gives a heavy yield, while Algerian, the latest of the lot, comes in well in providing green feed in September, and generally yields a good oat.

Of barleys, Skinless is perhaps the earliest; Cowra No. 36 next, and Cape the latest.

The experiments conducted during the past winter were variety trials. Owing to the shortage of seed wheat, varieties not recommended for the coast had to be sown to complete the plots, and it was found that the yields of some of these were satisfactory. Under average weather conditions, however, it is doubtful if these varieties would succeed. For instance, Hard Federation showed very little rust, and the returns were astonishing, but in a moist season this variety perhaps would fail owing to rust. It is satisfactory to notice the returns from the mixed fodder sections—wheat and field peas and oats and field peas. This practice of combining cereal and legume might well be adopted by dairy farmers, the feeding value being much higher and the bulk generally greater.

As far as soil matters are concerned, the following are the classes on which the work was carried out:—

Kangaroo Valley, formed from sandstone; ground flat.

Pambula, formed from granite and basalt hills; ground flat.

Milton, formed from sandstone; hillside.

Bega, formed from granite; flat.

Mittagong, formed from sandstone; flat.

The earliest crops harvested were those at Milton, which were cut early in August, and the latest were those at Mittagong, where harvesting was finished in November. All plots were manured with superphosphate at the rate of 2 cwt. per acre, and all were broadcasted except those at Mittagong, which were drilled in.

RESULTS of Green Fodder Trials.

Variety.	Kangaroo Valley.				Pambula.				Milton.				Bega.				Mittagong			
Date of sowing ..	30 April, 1920.				22 April, 1920.				25 March, 1920.				21 April, 1920.				28 April, 1920.			
Rainfall in points ..	792				662				....				....				999			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q	lb.	t.	c.	q.	lb.
Wheat—																				
Hard Federation	12	15	1	12	8	10	0	0	5	2	0	0	9	19	3	13	8	11	1	20
Firbank	15	14	1	4	8	11	1	20	4	8	3	26	9	9	0	7	7	0	0	0
Bomen	11	15	2	24		......				......				......				......		
Yandilla King ..	12	7	2	0	4	5	2	24	5	12	3	12		......				......		
Thew	10	16	0	8	3	4	1	4	4	9	3	12	5	13	1	21	6	5	2	24
Thew and Field Peas	13	8	0	4	3	11	1	20	5	8	0	8	6	15	0	5	7	1	1	20
Canberra.. ..		......			5	12	3	12		......			7	0	1	22		......		
Marshall's No. 3..		......				......				......										
Oats—													9	19	3	18	9	10	0	0
Algerian	16	13	3	24	8	0	0	0	10	16	1	20	16	4	0	12	7	4	1	4
Guyra	15	10	1	12	9	17	0	16	9	13	0	8		......			6	18	2	8
Sunrise	15	18	0	24	6	1	1	20	9	14	1	4	18	7	1	8	7	10	0	0
Sunrise and Field Peas	18	13	0	24	8	18	2	8	7	6	3	20	15	13	1	6	9	1	1	20
Ruakura		......				......				......			16	4	0	12		......		
Barley—																				
Skinless	15	18	0	24	5	14	1	4	5	14	1	4	5	18	3	10	7	0	0	0
Cape	10	16	0	8	4	2	3	12	6	1	1	20	11	6	3	14	6	4	1	4
Cowra No. 36 ..		......			7	1	1	20		......				......				......		

Central Coast.

J. M. PITT, Assistant Inspector of Agriculture.

TRIALS with winter fodders were conducted during the season on the following farms :—

J. G. Ward, Sherwood, Macleay River.
R. Lindsay, Gladstone, Macleay River.
T. Kemp, West Kempsey, Macleay River.
R. Richardson, Mondrook, Manning River.
W. Richardson, Dumaresque Island, Manning River.
V. Murray, Pampoolah, Manning River.
A. C. McLeod, Mondrook. Manning River.
J. C. Duff, Mt. George, Manning River.
W. H. Duffy, Barham, Comboyne.
Alex. Smith and Atkins Bros., Bandon Grove, via Dungog.
W. Smith, Bona Vista, Paterson.

The yields in all instances were satisfactory, those at Bandon Grove probably being heavier than any harvested in the district for many years. The winter proved disastrous to stockowners, the mortality amongst all classes of animals being extremely heavy. This is accounted for by the fact that the drought, which had commenced well back in the previous summer, did not allow of sufficient time during the remaining growing months to ensure a growth in the pastures for winter use; consequently stock entered upon the colder months in low condition.

Farmers fortunate enough to possess a plentiful supply of fodder crops not only prevented loss of life among their animals, but were rewarded with fairly good factory returns. A case in point may be recorded: Mr. McLeod, of Mondrook, fearing the worst, "broke" several acres of second-rate pasture land and sowed to winter fodders. The returns were remarkable, up to 15 tons per acre being harvested. Four acres fed thirty-two head of milking cows, four horses, and a number of young cattle for six weeks, the maximum amount being fed twice daily. Many of the beasts would undoubtedly have died without the supply. It is gratifying to note that other farmers similarly situated have decided to follow Mr. McLeod's example.

The practice of depending upon natural pastures has all along proved disastrous to farmers, and the sooner they awake to the facts the better. Success in all classes of cattle raising, dairying especially, depends solely upon an adequate supply of fodder being available throughout the year. Returns can in many instances be doubled, even trebled, if farmers would only feed and feed well. Having supplies of fodder, in both the fresh and the conserved states, is the best security against adversities.

The Season.

Prior to sowing, conditions were rather dry, rain being necessary in several instances to germinate the seed. Heavy downpours occurred during July, which were again followed by windy, cold, and dry weather, chiefly during August. However, useful rain fell in September, reviving the suffering crops.

The season was most suitable for the oat plots, and in almost every instance they supplied the heaviest yields. Guyra, a variety maturing slightly earlier than Algerian and sown largely on the tablelands, deserves special mention. It stools less than Algerian, but its strong, thick, succulent growth, especially at Bandon Grove and Mondrook, was most noticeable. It is usually susceptible to rust under coastal conditions, but the dry season of 1920 was responsible for almost a total absence of that parasite. Sunrise again yielded well.

Seed of the better known wheats, such as Huguenot and Warren, was unobtainable, but the substitutes, Bomen, Canberra, and Hard Federation, gave promising results. Although considerable lodging took place, the plots were remarkably free from rust.

Soil and Cultural Details.

Sherwood.—Soil, second class clayey loam. Previous crop, wheat and oats. Disc ploughed in December; disc cultivated at intervals until sowing time. Seed disced in on 21st April. Most of the plots lodged in parts during the windy weather, Bomen perhaps being the exception. These plots were far superior to any other crops grown in the district, the excellent cultivation methods adopted alone being responsible.

West Kempsey.—Heavy loam soil. Previous crop, maize. Ploughed January, and again previous to sowing. Sown 10th May. Cold frosty weather retarded growth.

Gladstone.—Rich alluvial soil. Previous crop, maize. Ploughed in January. Seed sown on 23rd March. Good growth, although crops were used for fodder earlier than usual.

Mondrook (McLeod's).—Poor shallow clayey loam. New land. Ploughed in December, followed by two other ploughings and numerous discings and harrowings. Sown on 21st April. Seed-bed rather dry and open. Excellent growth after June. Marshall's No. 3 was sown on a rough portion.

Mondrook (Richardson's).—Rich clayey loam. Previous crop, cowpeas, following winter fodders. Fed, burnt, and raked off owing to the great bulk of cowpea growth. Ploughed in March. Sown on 7th May.

Dumaresque Island.—Rich clayey loam. Previous crop, maize. Ploughed in January and twice more lightly before sowing to destroy weed growth. Sown on 19th April. The plots of Sunrise and peas and of Hard Federation and peas were the best seen on the island for many years.

Pampoolah.—Fairly rich heavy loam. Previous crop, maize. Ploughed in April (late). Sown on 21st May. Stooling sparse. Hard Federation and Sunrise plots very fair.

Comboyne.—Rich volcanic soil. New land. Disc ploughed in February, and on rough side when ploughed on 24th April. The plots were the best on the Comboyne for many years.

Bandon Grove.—Rich alluvial soil. Previous crop, oats. Ploughed in December, and again in February and April. Cultivated prior to sowing. Sown on 16th April. The plots of Guyra and Sunrise were magnificent, nothing better being seen on the coast for many years.

Yields.

Varieties.	A. C. McLeod, Mondrook.	R. Richardson, Mondrook.	Comboyne.	Sherwood.	West Kempsey.	Gladstone.	Pampoolah.	Dumaresque.	Mt. George.	Bandon Grove.	Paterson.
Date Sown	21 April, 1920.	7 May, 1920.	24 April, 1920.	5–8 May, 1920.	10 May, 1920.	23 March, 1920.	21 May, 1920.	19 April, 1920.	14 May, 1920.	16 April, 1920.	14 June, 1920.
Oats—	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.
Sunrise	11 18 3 0	....	7 9 1 0	15 8 2 8	....	12 0 0 0	13 4 1 4	13 2 2 0	9 0 0 0	20 8 2 0	7 14 1 24
Sunrise and Field Peas	....	11 12 3 12	....	17 11 1 24	11 3 0 0	....	13 6 0 8	....	....	....	....
Sunrise and Vetches	....	12 0 0 0	....	18 2 3 12	....	....	13 5 2 24	....	....	....	....
Guyra..	15 8 1 0	....	6 11 0 1	14 13 3 24	....	....	10 5 0 0	....	....	22 7 3 0	....
Guyra and Peas ..	....	10 11 1 20	....	....	....	....	....	....	....	....	....
Algerian	13 14 2 8	11 0 0 0	7 2 3 0	15 11 1 20	....	....	....	....	....	....	....
Algerian and Vetches	....	....	....	16 15 2 24	....	....	....	....	....	....	....
Wheats—											
Firbank	....	....	....	....	....	....	5 1 0 8	....	12 7 0 16	....	....
Marshall's No. 3 ..	4 5 2 24	....	8 17 0 0	....		....	....	....	....	....	....
Hard Federation ..	7 8 1 0	9 5 2 24	4 10 0 0	11 1 3 24	5 7 0 3	9 10 0 0	8 12 3 0	....	13 9 2 17	9 15 0 0	4 17 1 0
Hard Federation and Vetches.	....	....	....	....	....	....	....	17 12 2 0	....	....	....
Hard Federation and Field Peas.	....	....	....	....	....	....	12 19 1 8	....	....	....	....
Canberra	9 11 2 0	8 11 1 20	7 3 0 0	13 5 2 24	....	....	....	....	....	....	17 12 3 12
Bomen	10 11 1 20	....	....	11 1 3 24	....	9 0 0 0	....	....	....	....	....
Florence	....	7 10 0 0	....	11 17 0 16	....	10 0 0 0	....	10 14 1 0	....	9 4 2 2	....
Thew	....	7 15 0 0	....	11 3 2 8	....	11 10 0 0	....	....	11 3 0 24	10 10 2 24	4 15 2 21
Zealand	....	9 5 2 0	....	....	....	....	....	....	....	....	....
Currawa	....	....	6 2 3 0	....	....	....	....	....	....	....	....
Florence, at 3 bus ..	....	....	....	12 2 3 12	....	....	....	....	....	....	....
Thew and Vetches ..	....	....	....	....	10 10 3 12	11 10 0 0	....	....	....	....	....
Thew and Field Peas	....	....	....	....	....	10 10 0 0	....	....	....	....	....
Barley—											
Skinless	....	....	4 5 0 0	5 0 0 0	....	....	....	....	....	....	....

Mt. George.—Heavy alluvial loam. Previous crop, potatoes. Ploughed in December. Disced before sowing. Sown on 14th May. Crops cut for hay.

Paterson.—Low-lying clay soil, of poor quality. Previous crop, oats. Ploughed in April; sown on 14th June. Poor stooling, owing to the lateness of the sowing. Portion of the crops were used for hay.

All the plots were sown at the rate of 2 bushels per acre, excepting one plot at Sherwood. Vetches and field peas were sown at from 24 lb. to 36 lb. per acre.

MONTHLY Rainfall.

	Sherwood.	Mondrook.	Kempsey.	Mt. George.	Pampoolah.
1920.	Points.	Points.	Points.	Points.	Points
May ...	155	128	194	98	411
June ...	190	118	199	143	132
July ...	435	258	500	313	439
August ...	13	10	41	65	20
September	256	122	292	148	162

The rainfall at Kempsey may be regarded as approximately that also of Gladstone.

ORTLIPP'S BUNGOWANNAH WHEAT.

THIS variety of wheat, originated by Mr. Ortlipp, of the Albury district, has been favourably reported on in the press this season for its good straw. We found it behaving well in this respect this year, though in some seasons it is apt to lodge. The variety appears to be identical with Turvey or Turvey's Purple Straw. We had the two sorts sown side by side this season, and found them to be the same variety. Mr. Ortlipp's wheat may be a superior strain of Turvey, but it seems hardly worth while having the two names. Turvey is a midseason variety, coming into head at the same time as Warden and Dart's Imperial. It is a good cropper, and may be regarded as a general purpose wheat, though we consider it specially suitable for hay. It belongs to the Tuscan group of wheats—resembling White Tuscan, except that the straw is purple. The tall straw and abundant growth make it a desirable hay wheat, but in an average year it would not be safe to grow a very large area for stripping.—J. T. PRIDHAM, Plant Breeder.

CUTTING SUDAN GRASS FOR SEED.

THE experience of the Department has been that at any rate in New South Wales the second or third growth is the best for seed, though in America the first growth has been mostly used. This difference is chiefly due to the fact that the seasons in America are shorter than here, and that in many cases barely two cuts can be obtained there. Harvesting is done with the binder, and the sheaves are then stooked and threshed.—A. H. E. McDONALD, Chief Inspector of Agriculture.

Springside Crop-growing Competition.

[The Springside branch of the Agricultural Bureau of New South Wales conducted a crop-growing competition during 1920, and with the approval of the Under Secretary and Director, Mr. J. E. Syme, Inspector of Agriculture, acted as judge. His report, together with the table showing the individual scores, will be of interest to other branches of the Bureau.]

THE crops on the whole were very fine, one crop of Mr. Selwood's (Zealand wheat) being especially good, and if the crops on this farm had all been up to the same standard Mr. Selwood would have scored very heavily. Mr. Baker's crops were also extremely good. The chief fault noticed in all crops was the presence of "strangers," the seed not being true to type, while the oat crops in a good many cases contained numerous heads of wheat and barley.

Disease was not particularly in evidence, although every crop inspected contained some flag smut aud a few contained bunt or stinking smut. Rust was only noticed in one case.

A few of the crops would have done much better but for the presence of black oats, but as most of the land in the competition has been in cultivation or many years that fact is not surprising. The only remedy is a system of fallow and good cultivation.

The basis on which the points were allotted was as follows :—Yield, 1 point for every cwt. of hay; trueness to type, 20; freedom from defects and disease, 20; evenness, 20; cleanliness, first crop, 24; second, 25; third, 26; fourth, 27; fifth, 28; sixth, 29; over six crops, 30; cultivation, first crop, 24; second, 25; third, 26; fourth, 27; fifth, 28; sixth, 29; over six crops, 30.

The results are set out in the table opposite.

THE DEFECT OF FACTORY FARMING.

To the uninitiated, one sheep in a flock is as like another as is one Chinaman to another in the eyes of a European: but the shepherd knows every sheep by sight and by name, and his reward is that the sheep know him and do his purpose accordingly. So to a man with the right instincts every rise and fall in the ground, every curve of the hedge and every slightest change in the soil tells its own tale, and the land yields its full fruit only to him to whom that tale has a meaning. But these mysteries are learned only by patience and by the deep study of a small place—study such as most men will not give to anything except what is their own either by actual deed or long usage. And it is this factor which disappears when you force your farmer to become merely a working unit in the mechanism of a factory farm, too large for his full comprehension, and governed by a machinery of which he does not see or understand the driving force.—LIONEL SMITH-GORDON in *Better Business.*

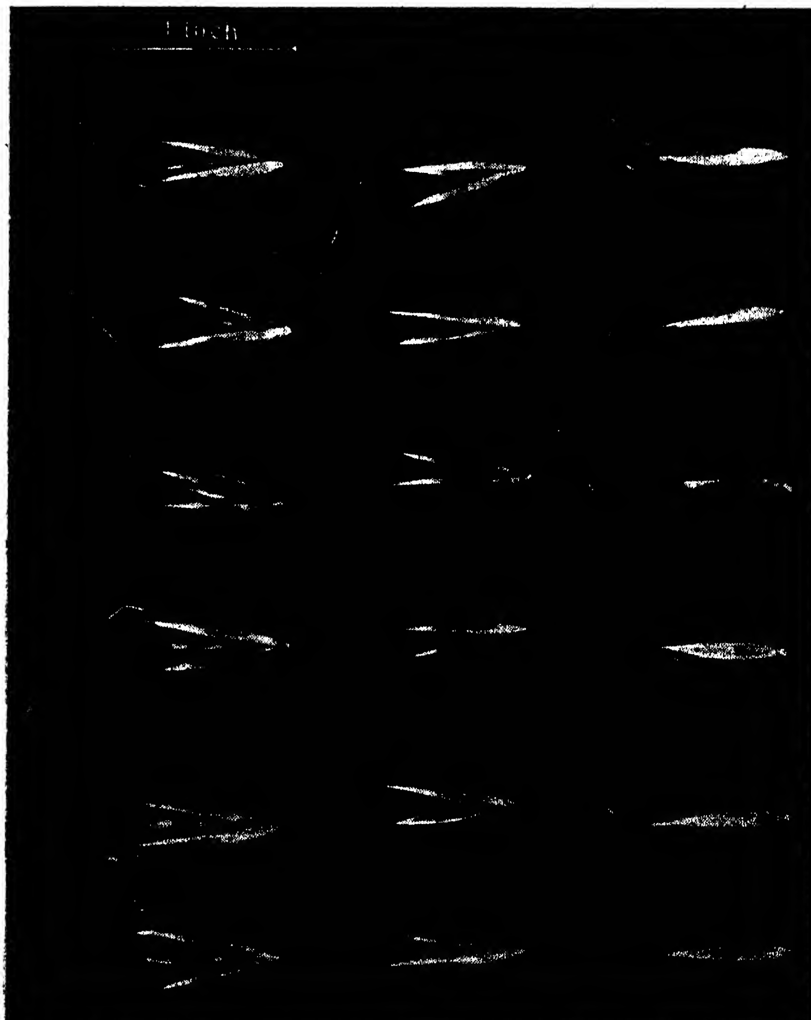
DETAILS of Awards of Springside Crop-growing Competition.

Name of Competitor.	Varieties.	Methods of Cultivation.	When Sown.	Quantity of Seed per acre.	Manure used.	Apparent yield.	Trueness to type.	Freedom from defects and disease.	Evenness.	Cleanliness.	Cultivation.	Total.
						pts.	pts.	pts.	pts.	pts.	pts.	pts.
E. H. Selwood...	Zealand, Algerian oats.	Three ploughings, two harrowings, and ground rolled before sowing.	....	1¾ bus. ...	Superphosphate ...	65	17	18	17	27	28	167
A. E. Baker ...	Yandilla King, White Lammas, Algerian oats.	Fallowed, three ploughings, cultivated once, drilled in and harrowed.	....	Wheat, 1¼ bus.; oats, 2 bus.	50 lb. superphosphate per acre.	63	17½	17	16½	27	28	166
T. Commins ...	Cleveland, Improved Lammas, Algerian oats.	Fallowed, three ploughings, cultivated twice	....	Wheat, 1½ bus.; oats, 1 bus. to 1¾ bus.	50 lb. superphosphate per acre on portion.	61	16	17	18	24	28	164
G. F. Giles ...	Dart's Imperial, Algerian oats.	Ploughed, some twice, some once; spring-tooth cultivated, harrowed.	Sown May and July.	Wheat, ½ bus.; oats, 1½ bus.	Proprietary hay special manure and superphosphate.	38	17	18	16	26	24	139
M. K. Bowen ...	Lachlan oats ...	Skim ploughed Jan., ploughed in March and harrowed.	Sown middle of April.	1¼ bus. ...	No manure	46	16	16	18	20	23	139
E. D. de Lauteur	White Hogan, Cleveland, Dart's Imperial, Algerian oats.	Ploughed once, cultivated three times, harrowed, drilled and harrowed twice.	... .	1 bus. ...	56 lb. superphosphate per acre.	48	14	15	17	18	20	132

The Origin and History of Sunrise Oats.

J. T. PRIDHAM, Plant Breeder.

THE history of Sunrise oats, which has now gained a definite position among the varieties grown in this State, dates back to 1910. In that year at Longerenong Agricultural College, Victoria, it was noticed that the Algerian variety



Seed from one mother-head of Sunrise Oats.
The mother-head was grown in 1919, and the seed sown in 1920 yielded the above. Each spikelet is from a separate individual plant.

sown in the breeding and trial plots showed variations which pointed to a natural cross having occurred. It was pure seed, as we thought, from the selection plots of the previous year. The differences noticed were in the

character of the grain and especially in the tallness and sparse stooling of some plants. These were very early and had stooled so little that it was almost decided to reject them on the score of light yields.

The Produce of another mother-head of Sunrise Oats.
ch spikelet is from a different individual of the progeny.

Eight plants were sown in separate plots at Cowra when I resumed work there in 1911, and one of these ripened before Algerian, though sown three weeks later. The plants in this plot were similar, and, with the exception of

three, had white grain; the exceptions produced black grain, which was less hairy, however, than that of the wild oat. One of these black-seeded plants was sown in 1912 and yielded plants varying in colour of seed, hairiness of hull, and coarseness of awn, all the progeny more or less resembling the wild oat. The predominant white-grain type was sown and all selections of this bred true. It was therefore decided to grow the variety on a larger scale and it was named Sunrise on account of its early maturity.

As a matter of fact the oat was not quite fixed, the grain of some individuals being of a creamy white and in others a pale dun, though to any but a trained breeder the selections as viewed in the plots appeared quite uniform. The plants kept for sowing in 1913 all had creamy white grain, and in 1914 also our judgment seemed confirmed. In 1915, however, one of the mother plants in the selection plots showed variations in foliage and degree of stooling. These variations showed again in 1916 and selections which seemed more productive than the original were saved, while still carrying on the Sunrise type as before. Some plants produced a shorter kernel and stooled somewhat more than the original, the colour of the hull varying from pale yellow to pale brown—some had weaker straw than Sunrise. A strain that had yielded best of the series in 1917–1918 was named Cowra No. 25. In 1919 another strain almost as promising was named Cowra No. 27, these two going into larger plots for trial. Both these appear to be fixed; also a strain, "75 (C_2)," which is decidedly earlier than Sunrise, with strong straw. The original strain of Sunrise, however, has continued to show variations, though these are not noticeable in a crop to the casual eye.

Last season we gathered a large number of single ears or heads from a crop of Sunrise and classified them according to the presence and stoutness of awn, coarseness of straw, hairiness or otherwise, and colour of seed, sowing the selections separately in ear-to-row plots. Some of these have bred true and some varied greatly in their progeny. Some plants shook out their grain badly like the wild oat, and showed the horse-shoe mark at the base of the seed; others had an attachment like the Algerian or *A. sterilis* oat. In some the awn was extremely coarse, and in others quite slender. The degree of hairiness ranged from very hairy to smooth and glabrous. Colours seen were black, brown, dun, yellow, and creamy white. In one of these plots, among a number of such variations typical of the wild oat, a plant was found fully answering to a description of the original Sunrise type.

From the data above presented it appears as if the Sunrise oat has arisen from a natural cross between the wild oat (*A. fatua*) and Algerian (*A. sterilis*). A natural crossbred in oats has already been described in this journal.

In 1921 we expect to grow enough seed of the new Sunrise for sale to farmers in 1922, and in the meantime the Sunrise on the market is sufficiently pure for all practical purposes. Where seed of Cowra No. 25 is procurable it is quite equal to Sunrise.

Sheep-raising on the North Coast.

DEPARTMENTAL EXPERIENCES AND OBSERVATIONS.

J. WRENFORD MATHEWS.

SHEEP-RAISING has proved so profitable an occupation in most parts of New South Wales, that the prospects of a possible extension of the industry to other districts not so well adapted for it are usually viewed with favour by those not thoroughly conversant with the governing circumstances. Climate is a primary factor contributing to the success or otherwise of sheep-raising. Suitably placed as regards breeds, sheep will thrive equally well in a hot, dry climate as in a wet one, but few breeds will adapt themselves to a humid climate. New South Wales possesses climatic conditions which range from cold and dry to hot and dry, but in the northern river districts the atmosphere attains a high state of humidity. For trial in these districts, the Romney Marsh sheep, which has been bred for generations upon the lowlands in the county of Kent on the seaboard in the south-east corner of England, was considered the most suitable breed, as being naturally adapted to damp pastures and wet conditions; but even such conditions do not entirely coincide with those of our North Coast, for there is a difference between a hot, damp climate and a cold, bleak, wet one.

Trials at Wollongbar.

For a number of years prior to 1909, a small flock of Romney Marsh sheep was under observation at the Wollongbar Experiment Farm, near Lismore. In 1910 the sheep were carefully inspected, and following is the text of an official minute submitted as to their progress:—

"Acting under directions, I visited the Wollongbar Farm and inspected the sheep there stationed. The flock comprised a small number of the Romney Marsh breed. These, I gathered from the records, had been on the farm for a good many years, but very little success has been achieved with them owing to the unfavourable conditions prevailing. The climate is damp and moist, and the herbages unsuitable. Diseases are prevalent, while a still greater drawback to sheep kept under these conditions is the very small rate of increase. This could only naturally be expected considering the fat and flabby condition of the ewes, due to the succulent nature of the pastures. Furthermore, great trouble has been experienced owing to the prevalence of the bush tick. There are many different varieties of this form of tick, but the one which is most harmful to the sheep is the smaller variety (*Ixodes holocyclus*). It appears to be most venomous and attacks dogs, cattle, and other forms of livestock, and particularly sheep. It is found on the legs and other parts of the body not protected by wool. This particular variety is more usually found on the lambs and on sheep freshly introduced into the district. Lambs when bitten very often die, but singularly enough

sheep when affected as lambs appear to become afterwards immune. Originally coming from the scrub it now abounds in the pastures, and its ravages are such as to almost preclude sheep-raising, at all events within the area known as the 'Big Scrub.'"

Trials at Grafton.

Slightly different conditions prevail in the districts of the lower rivers, extending to the south of the Clarence; the climate there is less humid, and the pastures less soft and succulent. It may be mentioned, in parenthesis, concerning pasturage that sheep will always thrive better on a variety of pastures than when confined to one single kind; perhaps of all classes of stock they are most fastidious in their feed—they dearly love to pick about and choose at their own sweet will all varieties of grasses that the pastures afford. Left to themselves they show a distinct preference for the shorter and finer kinds. This is why sheep should be changed from pasture to pasture or from field to field, and why, when continuously grazed by sheep, land will develop a denser and more permanent sward.

Records supplied by the Government Statistician show that for the past nine years the average yearly rainfall at Wollongbar was 53·7, and at Grafton 32·2 inches, so that there is a considerable difference between that of the two localities. It was mainly because of the differences in the conditions prevailing that it was decided to transfer the sheep from Wollongbar and place them under observation at Grafton Experiment Farm. When instituting this fresh series of trials the flock was further augmented by the addition of ninety-three ewes from the Hawkesbury Agricultural College at Richmond, and a small draft of ewes purchased from Mr. George Doyle, of "Cardington Hall," Molong.

The trials commenced at the beginning of 1910, and the sheep remained under observation until 1915. The area, embracing about 1,300 acres, is of an undulating nature, and the sheep had access to both high lands and flats. The sheep were grazed mainly on the native grasses, and had limited access to artificial pastures, which consisted chiefly of lucerne. The animals were given the best treatment that the conditions would afford. A liberal amount of salt in the form of a lick was made accessible, provision was made for dipping, and to combat worm infestation the sheep were regularly drenched with the ordinary arsenical drench prescribed by the veterinary officers of the Department. Despite all reasonable care in the way of treatment and management, however, the flock failed to make satisfactory progress. The increase was much below the average, and the lambs, after being weaned, appeared stunted, and seemed indisposed to thrive.

In 1914 a report was asked for from the manager, and it clearly indicates the progress made so far with the flock. *Inter alia* he states:—

"During the year 1913 the sheep on the whole did better than formerly. This is due to two factors, viz., the dry season prevailing and the culling of old sheep, &c., by the sheep and wool expert. The flock at the present time is infinitely better than it has ever been, although the increase has not been satisfactory.

"On 31st December, 1912, the number of sheep on the farm was as follows:—Rams, 4; ewes, 86; wethers, 9; lambs, 59; total, 158. On 31st December, 1913, the numbers stood as follows:—Rams, 5; ewes, 85; wethers, 7; lambs, 47; total, 144. During the year seventy lambs were born, thirty-three sheep died from various causes, and thirty-six fat wethers were sold. The revenue from the flock was: Wool sold, £24 8s. 4d.; sheep sold, £27 13s.

"The general flock was depastured on two paddocks, comprising 58½ acres, and the sheep also had access periodically to an 8¼-acre lucerne field. The rams when not running with the flock were kept in a small paddock by themselves. On 9th December last, the Sheep and Wool Expert culled fourteen old broken-mouthed ewes and five ewe hoggets, and twenty-six lamb wethers were marked for disposal.

"*Remarks.*—It is necessary to state that the losses during the year are in part due to bush ticks and worms, but mainly, I think, through breeding from old ewes not able to nourish their lambs properly; these, together with climatic influences, account for the deterioration noticed in some of the sheep. Future losses should now be lessened through the more severe culling.

"After ten years observation of sheep on the North Coast, I am of opinion that it is doubtful whether this breed of sheep can be kept at a profit in any but small numbers, and that if the same energy and capital were expended on any other class of stock much larger profits would be realised. The revenue (£52 1s. 4d.) from the flock for the best year experienced is not satisfactory. The test is being carried out on land worth £15 per acre (66¾ acres), so that the interest on the capital value of the land at 5 per cent. is about £36, and the annual cost of labour alone is estimated at £30; hence a loss for the year of £14 is shown."

Following upon this report it was decided to allow the flock to remain under observation for another year. Meanwhile a record of the weights of wool produced during the three preceding years was obtained, and they are shown in the following table:—

Year.	Number of sheep shorn.	Total weight of wool.	Average per head.
		lb.	lb. oz.
1912	101	686	6 12
1913	110	660	6 0
1914	94	628	6 12

The wool was sold and realised an average price of 8½d. per lb.

The flock was again inspected in 1915, but there was no perceptible improvement, despite the fact that the flock had been rigorously culled and fresh rams introduced at different intervals. The sheep bore evidence of decline, and, although the male stock was allowed to remain entire to a fairly matured age, the sheep were not considered of high enough standard to distribute for breeding purposes.

Following is the text of a final report from the manager, and acting on his recommendation the flock was moved to more congenial surroundings:—

"This experiment has now reached the stage at which further prosecution on similar lines is not warranted. During the whole period under review the sheep have not done as well as was expected; neither from a wool nor from a mutton point of view have they been satisfactory. Compared with all other stock at this farm, the sheep have consistently proved to be the least remunerative. Intestinal and lung worms have been a very irritating source of losses, and the scrub tick have usually carried off a number of the lambs, but the outstanding feature seems to be the general tendency to degenerate, which is no doubt due to the adverse climatic conditions.

"As the land occupied by the sheep can be more profitably utilised, I beg to suggest that the flock be either disposed of or removed to a more suitable locality."

Conclusions.

After watching the experiments closely and periodically inspecting other flocks on the North Coast, I am firmly convinced that sheep-raising can never displace such a thoroughly well-established industry as dairying. Sheep-raising certainly offers certain advantages in supplying the household with a very necessary article of diet in the form of home-grown mutton, but beyond this I can see little prospect of the industry ever being extended. Even to conduct sheep operations on this small scale, due care and precision will require to be exercised in the choice of localities. Besides this, the flock will require to be under constant and vigilant observation in order to detect the signs or symptoms of diseases to which sheep are prone under such adverse surroundings. The country chosen should be high land with a light soil and its characteristic fine and short grasses.

From observations taken during the tests it was most evident that paspalum as a sole article of diet is unsuitable for sheep. They became fat and flabby, and exhibited great distress at the least possible exertion. At its best, sheep-raising could only be viewed as a side-line in this district, and where the richer flats lie in proximity to sloping ground, the flock may be maintained to greater advantage if the food supply be augmented by the growth of some nourishing form of crop that is relished by sheep. Whether or not the flock is to be retained on permanent lines, or whether sheep are to be periodically introduced from other districts is a matter for mature and grave consideration. If retained permanently fresh blood will require to be introduced from time to time to maintain the virility of the breeding stock and to re-invigorate the strain. On the other hand, if sheep are merely brought to the district for fattening, care should be taken to see that they are as free as possible from disease.

Of all breeds, the Romney Marsh is undoubtedly the most suitable of those so far known for the North Coast. Effective measures, however, will always be required to restrain the prevalence of disease so common to the locality. In the first place, the sheep should always have access to a plentiful supply of salt in the form of a lick. They should as far as possible be kept away

from all stagnant pools where the land is not effectively drained, and above all regular and systematic drenching should be carried out. Worm troubles are usually indicated by a debilitated appearance and pallidness of skin. Fluke is also likely to be prevalent under such conditions, and is usually depicted by yellowness about the inner part of the eye, on the tongue, around the gums, and more or less over the roof of the mouth. Prompt fattening, prior to rapid and serious decline, is further evidence of the ravages of this disease. External treatment will be of little avail in the case of fluke. Affected sheep should be immediately removed to higher lands and more nourishing feed.

Ordinary intestinal and stomach worms may be dislodged by the administration of approved drenches, which may be prepared from 1 oz. arsenic, 2 oz. washing soda, and 1½ gallon water. The arsenic and washing soda should be boiled for half an hour in ½ gallon of water, and then sufficient added to make the liquid quantity up to 1½ gallon. The mixture should be given time to settle, the liquid content poured off, and the remaining sediment buried. The first drench should be given about the middle of February and the treatment renewed at monthly intervals to the middle of April. Worm attacks may in a great measure be combated, as this is the period of the year in which the flocks seem to be worst affected.

To effectually administer the drench the sheep should be placed firmly on its four legs. The animal should be handled as quietly as possible, and on no account should violence be used. The dose should be given when the paunches are empty, and for this reason the sheep should be placed in an enclosure where they will receive neither food nor water for about fifteen hours prior to administering the drench. To get the best result from the treatment prescribed, about six hours should be allowed to elapse after the administration of the drench before the sheep are released. They should then be put on a fresh crop of succulent feed such as rape, barley, &c., or, if this is not available, upon a field of natural pasture that has been kept in special reserve. The quantities given are as follow:—Young sheep (weaners), 1 fluid oz.; older sheep, up to 1½ oz. A proper drenching horn designed to the right quantities should be used for the purpose.

Apart from this the sheep should be dipped regularly at from one month to six weeks after shearing. Where the flock is not sufficiently large to warrant the outlay and expenditure of a properly constructed excavated dip, a small dipping bath may be used as a mode of convenience. It would be well always to use a reputable proprietary preparation and pay due heed to the directions given as to the prescribed strengths and method of application.

The question of shearing is one for consideration in districts of such high rainfall as those on the North Coast. The object should be to have the sheep as free as possible from wool during the period when the rainfall is most excessive. For this reason it has been advocated that the sheep be shorn twice during the year. Obviously this would, in a great measure, prevent a wet, steamy condition in the fleece due to continual saturation. The sheep

might be shorn advantageously late in spring and again in autumn before winter finally sets in. Some will probably disagree with this view, contending that it would detract from the value of the wool by reducing the standard length of staple. It should, however, be borne in mind that the sheep are being kept under somewhat extraordinary conditions, and the value of the fleece is only of secondary importance. The sheep are kept primarily for mutton for local consumption, and the health and stamina of the flock should precede all other considerations.

Some Recent Publications.

Such of the undermentioned publications as will be of interest in connection with the particular branch of agriculture in which they are engaged may be obtained free of charge by orchardists and farmers, on application to the Under Secretary and Director, Department of Agriculture, Sydney:—

Plant Diseases Leaflets.

No. 1. Black Rot.
No. 2. Bitter Pit.
No. 3. Bitter Rot or Ripe Rot.
No. 4. Brown Rot.
No. 5. Black Spot of the Grape Vine.
No. 6. Downy Mildew of the Grape Vine.
No. 7. "Bullet," or Woodiness of the Passion Fruit.
No. 8. *Fusarium* sp. or Root Rot and *Sclerotinia* sp. of Passion Fruit.
No. 9. Apple Scab or Black Spot.
No. 10. Brown Spot of Citrus Fruits.
No. 11. Black Spot of the Orange.
No. 12. Powdery Mildew of the Vine.
No. 13. Powdery Mildew of the Apple.
No. 14. Brown Spot of Passion Fruit.
No. 15. Peach Curl.
No. 16. Peach Freckle.
No. 17. Crown Gall of Plants.
No. 18. Root Rot of Fruit Trees due to *Armillaria mellea*.

The Department has also made available Farmers' Bulletin, No. 134, "Soil Improvement for Maize, Part I, Manures and Fertilisers," which is obtainable from the Government Printer, Sydney, price 10d. per copy, post free.

To Preserve a Rural Population.

Above and beyond questions of bulk of production, price of food and individual prosperity, it seems to me that the great problem we have to solve is that of keeping a healthy and contented population on the land. If this be done, the other results must, I feel, follow of themselves. And this problem can be solved only by certain means, namely, improving the relationship between farmer and labourer, softening the contact between countryman and townsman, and making the life of the farmer and his helpers as interesting and as little monotonous as that of the workers in any other industry. —Lionel Smith-Gordon in *Better Business*.

Chats about the Prickly Pear.

No. 9.

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.,
Government Botanist, and Director, Botanic Gardens, Sydney.

American and Australian Problems Different.

Dr. David Griffiths is the officer of the United States Department of Agriculture who is charged with the experiments of that Department in regard to prickly pear, and no worker has the same practical knowledge of the subject as he; he is in control of the Department's pear station at Chico, California. It will be observed how frequently I have quoted him in these articles. He has read them and the following interesting observations have been made by him in a recent letter:—

The aspect of the pear situation is very different with us than with you. In our arid regions we welcome a growth of prickly pear, while you are afraid of it. Pear does not spread with us as it does with you, owing to the fact that we get practically no seed germination. In ten or twelve years I have never seen in our plantation at Chico, California, but one season in which we got abundant seed germination, and this succumbed to succeeding dry weather. In short, you have moist, warm weather. Our warm weather is very dry. You readily see why seed does not germinate with us. When we happen to have a heavy September rain in California seed will germinate, but it very seldom is able to live through the drought of the succeeding summer. Similar conditions exist in the pear regions of Texas.

Spines and Manuring of Pear.

I have a note on spines in prickly pear in this *Gazette*, April, 1911, page 324, and a paper entitled "The Cultivation of 'Spineless' Prickly Pear" (report on experiments at Nyngan) in this *Gazette* for October, 1917, page 740. I may add that these experiments, which were carried out 382 miles west of Sydney, were conducted on unmanured land.

Dr. G. V. Perez wrote to me under date 24th October, 1913, from the Canary Islands, making the following interesting statement:—

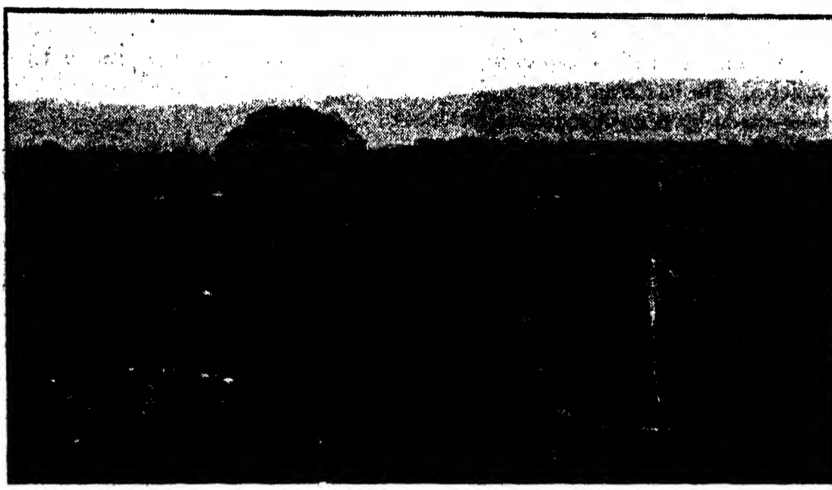
This is perhaps the only country where these plants were grown in fields under an intensive cultivation (guano, irrigation, &c., &c.) for the production of the cochineal insect, of which the exports to England amounted at one time to nearly £1,000,000 annually. It was grown on different species, one of them being *Opuntia tomentosa*. My late father and Dr. Sagot, in their pamphlet "La Vegetation aux Iles Canaries," *Journ. de l'Agric. des pays Chauds*, Paris, 1867, drew attention to the fact that Opuntias under intensive cultivation became less spiny.

Dr. D. Griffiths has written at length on "Spine Variation" in Bulletin No. 31 of the United States Department of Agriculture (December, 1913). He obtained a large spineless form from Malta, and planted it out at his experimental plantation at Chico, California. It developed spines to a greater extent than did those referred to by me in the Nyngan experiments. Dr. Griffiths' further experiments showed that the development of spines may be associated with a bilateralism in the joint; that is, there may

develop a marked difference in the amount of spininess in the two faces of a joint. I would like to see the Nyngan experiments already referred to continued by competent observers in different districts, with and without manure.

Pear Burners or Torches.

I have already referred to this matter in Chat No. 3 (this *Gazette*, May, 1920, page 327). There are two good machines made in Texas and used largely in the United States at the present time, but as prices are uncertain and fluctuating, inquiries should be made as to their cost. I most earnestly recommend that these pear torches be thoroughly tested in New South Wales by stockowners.



Prickly Pear (*Opuntia inermis*) near Scone.
A neglected common on the left; well kept private land on the right.

Prickly Pear and Abattoirs Products.

Another method of tackling prickly pear is to combine it with by-products of abattoirs; the combination makes a valuable stock fodder. The experiments of Mr. W. H. Payne, manager of the department which treats such products for the Metropolitan Meat Industry Board at Homebush Bay, are full of promise.

Further References to Pears Locally Acclimatised.

The following are some additional references to the various pears which have become acclimatised in Australia:—

Opuntia aurantiaca.

[Previous reference, with figure, this *Gazette*, April, 1911, p. 321.]

South Africa is cursed with this particular species to a very much greater extent than we are in New South Wales and Queensland. It is known in that country as jointed cactus or jointed prickly cactus, and is usually referred to as a vile pest separate from the larger jointed species, which go

under the name of prickly pear. I need scarcely say that it is a true prickly pear or opuntia, and I reiterate that it is one of the worst of all species. There are many references to it in Cape literature, particularly the *Agricultural Journal of the Cape of Good Hope.* It is only within the last few years that it has extended from the Cape to the Orange Free State and the Transvaal. Two papers giving the South African view of it will be found in the journal already quoted, Vol. XXIX, page 812, and Vol. XXXII, page 341. The latter paper gives an account of various chemical preparations used for fighting it. In South Africa it is referred to as *Opuntia pusilla* Haw.; but, through the kindness of the late Professor H. H. W. Pearson, of Cape Town, I have received specimens which show it to be *Opuntia aurantiaca,* which is so firmly established in our own State.

Now that we know that we have the same species to cope with, we shall the more intelligently follow the experience and efforts of our South African friends. A character of this plant is the brittleness of its small joints, which tenaciously adhere to the legs, hides, and fleeces of animals, and are hence carried over long distances. (Our own pest pear is not propagated much in that way, the joints being individually too large.) Where it appears in a new district it can be readily dug up and destroyed, preferably by burning. The burying method can be adopted, but such a method places the farmer at the mercy of a careless servant, since the work may not be perfectly carried out.

It is idle to say that we cannot afford to destroy this pest; as a matter of fact, we cannot afford not to destroy it. So far as my experience goes it is only found in a few districts at present. In September, 1912, I believed that a few hundreds of pounds at the outside would annihilate it, provided there be co-operation on the part of Queensland, but I do not think so now.

Besides the localities given by me in this *Gazette* for April, 1911, and March, 1912, I have received specimens of this variety from Sofala and Bundarra, both in New South Wales. I do not profess to have kept a exhaustive record of the spread of this pest. We worry about weeds which have not a hundredth of the virulence of this peculiarly insinuating and noxious pest.

Opuntia elatior MILLER (*O. nigricans* Haworth).

The question as to the identity of *O. elatior* was raised by me in this *Gazette* for October, 1913, page 864, under the heading *O. monocantha.* In the *Agricultural Journal of India,* Vol. IX, Part 4, page 362, is an article by Dr. W. Burns, entitled "*Opuntia elatior* Mill.: The Prickly Pear of the Bombay Presidency." At page 363 is the statement: "The excellent coloured plate of *Opuntia nigricans* given in the *Agricultural Gazette of New South Wales,* 2nd March, 1912, facing page 210, is undoubtedly the plant called *Opuntia elatior* by Burkill."

As *O. nigricans* is a later name, it must give way to *O. elatior.* This variety is not rare on the roads in the neighbourhood of Bringelly, Liverpool district, New South Wales.

O. inermis P.DC. var.

[See this *Gazette*, August, 1912, p. 713.]

This is the pest pear of New South Wales and Queensland. The accompanying photographs show (1) pear on Scone Common, stretching in one direction as far as the eye can reach, and alongside clean private land; and (2) a view of a Belar (*Casuarina lepidophloia*) scrub at Dulacca, Queensland, showing twelve years' growth. The first photograph was taken by Mr. Arthur C. Jackson, of Scone, in 1906. When I was conducting experiments on behalf of the Government, local residents often asked me why the common should not be as clean as private land, and it was not easy for me to reply.

Prickly Pear (*Opuntia inermis*) in

Belar scrub at Dulacca, Queensland, infested with pear of twelve years' growth.

The Queensland photograph was given me by Mr. Arthur Temple Clerk in 1910, and gives a very good idea of the strangle-hold that pear has got in some localities. But it is not fair to believe or to act as if all pear country were as hopeless as that. We must first get busy with the sparsely infected areas, where the pest is often allowed to spread unchecked as if it really did not matter.

THE VELVETY PRICKLY PEAR (*Opuntia tomentosa* SALM-DYCK).

[Previous reference this *Gazette*, December, 1912, p. 1027.]

In the above article are no photographs showing the appearance of this very large species. It attains a height of 25 feet, and when young is spinescent, but it is almost harmless. Mr. Temple Clerk, who sends the two accompanying photographs from Helidon, near Ipswich, says that it is found as far west as Emerald, 166 miles west of Rockhampton.

Prickly Pear (*Opuntia tomentosa*) in Queensland.

A clump growing in the Helidon district, near Toowoomba, Queensland. Note the crop of fruit, and the young plants growing below.

CONFUSION OF *Opuntia ficus-indica* AND *O. robusta.*

[See this *Gazette*, January, 1913, p 49.]

In a recent letter to me Dr. G. V. Perez says:—

> In the report of the Queensland Prickly Pear Travelling Commission, at page 44, *Opuntia ficus-indica* is stated to be the species on which the cochineal insect was raised in these (Canary) islands, and that there is another and larger species that they call *O. robusta.* It is the latter plant only which agrees with the picture given by you under the former name.

A few months later Dr. Perez wrote:—

> Then Mr. Lowe (Manual Flora of Madeira, page 317, 1868) referred to *O. ficus-indica* L., which is a much more robust plant here, with yellow flowers and a purple-fleshed fruit, sweet and much liked, which is figured in your No. 6 as the Barbary Fig. and with the same botanical name.

And again:—

> I lately asked the Director at Kew to kindly send me an article, and they mention (Bulletin of Miscellaneous Information, No. 9, 1912, page 395, "Opuntia in the Canary Islands") *Opuntia robusta* Wendl. My humble opinion is that this plant is the one that you have figured as *O. ficus-indica*, which has yellow flowers (not red or flame coloured), and in the Canaries the fruit is reddish inside, not whitish. I should like to know what you have to say on the subject with your large experience of these plants.

I adhere to my determination that the plant figured in this *Gazette*, January, 1913, page 49, is *O. ficus-indica. O. robusta* is a very different plant. It is the Nopal Tapon of the Mexicans, and a photograph of it is reproduced at Plate V of "Prickly Pear and other Cacti" by David Griffiths and R. F. Hare (Bulletin, New Mexico, U.S.A., No. 60, page 69). The plant is commonly 5 to 7 feet high, but it may attain a height of 12 to 15 feet, while the joints are nearly circular, often 18 to 24 inches in diameter and 2 inches thick, with plenty of spines. The fruit is nearly globular, and is deep blood red throughout. It is much eaten by the Mexicans as a fruit, although it produces constipation, even fatal in its effects, in many. It is also referred to in Bulletin New Mexico, No. 64, page 61.

It has a number of synonyms, of which *O. grandis*, *O. albicans*, and *O. piccolominiana* are the best known. It does very well in the Sydney Botanic Gardens. It is at once known by its huge, nearly circular, joints and globular crimson fruits, which are very different to the egg or barrel-shaped fruit of *O. ficus-indica.*

I shall draw attention later to the variation in colour of flower and flesh of fruit of certain pears attributed by some authors to *Opuntia ficus-indica.*

THE PEAR-FRUITED PRICKLY PEAR (*Opuntia monocantha* HAW.).

[See this *Gazette* for October, 1913, p. 863.]

This is the species best known to Australians in which there is abundant proliferation of fruit. I have dealt with this at page 864 (*op. cit.*), and Dr. D. Griffiths, Bulletin No. 31, United States Department of Agriculture, has a chapter (page 19) dealing with this phenomenon which, in some cases, is brought about by attacks by plant-lice. There is some correlation between proliferation and sterility; this is certainly borne out in regard to the species now under review.

Prickly Pear (*Opuntia tomentosa*) in Queensland.

Another clump in the Helidon district. Note the size of the trunk.

Opuntia elatior (see page 865 of article mentioned above) is *O. nigricans*, and has been already referred to.

At page 864 of the *Gazette* article mentioned, I remind my readers that in the year 1795 the wild cochineal insect destroyed *Opuntia monocantha* to such an extent in India that this prickly pear would have been wiped out had not the Government prevented it. This Indian experience of nearly a century and quarter ago was tried in Queensland recently with the same result, but so far we have not improved on Indian results, for no wild cochineal or other insect has yet been found to keep any other pear in check, much less the pest pear.

Attention may be invited to the proliferousness of the fruits of this species. There are few references to the phenomenon in literature. "They remain attached to the plant for four or five years, putting forth new ones from year to year, until there is a string of them sometimes 6 or 8 inches long, containing eight or ten individual fruits," write Griffiths and Hare in New Mexico Bulletin No. 60, page 61. "Not only do the fruits remain on the shrub, but they continue to grow as long as they are so attached, the proximal always being larger than the distal ones."

Dillenius' Prickly Pear (*Opuntia Dillenii* Haw.).

[See this *Gazette*, December, 1913, p. 1073.]

Mr. Temple Clerk pointed out to me that the pear shown in Fig. 2 in the article mentioned above is probably not this, but an allied species, and that that in Fig. 3 is undoubtedly an allied species. Both photographs are from Gayndah, Queensland.

Mr. J. L. Boorman tells me that he has seen *O. Dillenii* at Eight-mile Plains, near Brisbane, and Mr. Clerk says it is at Taroom, Queensland. I have already stated that I saw it at Dutton Bay, near Port Lincoln, South Australia.

Queensland Prickly Pear, A.

Dr. D. Griffiths says: "I think this must be my *Op. chata,* and is a native of Mexico."

The Cochineal Pear, *Opuntia cochinillifera* Mill. (Synonym *Nopalea cochinillifera* Salm-Dyck.)

[See this *Gazette*, October, 1914, p. 883.]

This is probably the most important of the food plants of the true cochineal insect, while it is a true "spineless pear," and may be cultivated by anyone who may desire to try pear as feed for pigs or cattle.

A Scone Prickly Pear.

"Your other unpublished species I am not able to make a guess on, namely, your No. 13 (a Scone prickly pear). I judge, however, that it is of Mexican origin." (Extract from letter of Dr. D. Griffiths, dated 21st October, 1920.)

The Production of Lucerne Seed.

With Some Reference to Lucerne Culture in our Drier Districts.

J. N. WHITTET, Assistant Agrostologist.

The value of acclimatised seed of all classes of crops is rapidly being recognised by our farmers. In New South Wales we find that the three main strains of locally-grown lucerne seed are Tamworth, Hunter River, and Mudgee, and a grower in any one of these districts will invariably endeavour to obtain seed which has been produced in the district.

Of later years the cultivation of lucerne has spread to the drier parts of the State, and good results have been obtained in the Bathurst, Coolah, Canowindra, Binnaway, Coonabarabran, and Pallamallawa districts—in the production not only of hay crops, but also of seed.

The value of lucerne for grazing purposes has long been recognised by pastoralists, and, in a good season, the first cut (and sometimes also the second) is made into hay, and the fields are turned over to grazing for four or five months, due consideration being given to the judicious spelling of the areas, in order to allow them to recuperate. In the feeding of lucerne, the fact must not be lost sight of that the crop may cause hoven or bloat in cattle and sheep; but where the animals are regularly grazed on lucerne, very little trouble is experienced.

As clover will not withstand hot, dry conditions, lucerne is now being planted in permanent grass mixtures in such parts of the State as the Riverina and central-western plains. Being a deep-rooting crop, it is able, when well established, to live through droughty periods. One to two pounds of seed in a grass mixture is ample to sow per acre. When included in a grass mixture, there is very little danger of lucerne causing hoven or bloat in stock, as the animals will be feeding over a mixed collection of pasturage. Established lucerne fields which are used for hay, seed, or grazing purposes, will benefit greatly from occasional cultivations of the surface soil. This work breaks up the hard surface crust, aerates the soil, and allows the rain to penetrate through it. Spring-tooth cultivators, or spring-tooth harrows, fitted with special lucerne points, give excellent results, stirring the soil to a depth of 2 to 3 inches. At Yanco Experiment Farm a fixed (not spring) tooth cultivator is used for working the lucerne fields, and stirs the soil well without causing much injury to the plants. Where lucerne fields are irrigated, a disc cultivator should not be used, as the plants become cut, and water settles in the crowns, and may cause the roots to decay.

The method recommended for planting in the drier parts of the State is to sow the seed in drills, 30 to 36 inches apart. This enables cultivation to be carried out between the rows, and so maintains a friable surface soil, and helps to conserve moisture. It has been noted that the partial isolation of plants increases seed production, as seed develops over the entire plant, and not at the top only as is the case in a thickly-sown field. Where plenty of moisture is available, the second growth from the crown of the plant comes away rapidly, thus reducing the amount of energy devoted to the production of seed. Nevertheless, the soil must contain sufficient moisture at all stages of the growth of the crop to maintain the plants in a healthy and vigorous condition. Any check the plants receive will considerably affect the quantity and quality of the seed. If the plants are not developing favourably, the crop should be harvested for hay.

Varieties under Observation.

The varieties being tested at the various experiment farms in the drier parts of the State comprise selections from the best of our local strains and also introduced varieties. At Bathurst Experiment Farm the following varieties are being grown: Tamworth Broad Leaf, China, Cossack, Semipalatinsk, Montana, Kansas, and Bathurst Nos. 6 and 9.

The China variety was obtained from Pekin plains by Mr. M. Meagher of Bathurst, and besides being a very promising lucerne carrying a large amount of leaf, is a good stooler. Cossack, Semipalatinsk, and Kansas lucernes were obtained from the United States. Cossack comes with the reputation of being the best of the Russian alfalfas for general purposes; it it has fine vigorous stems, which are very leafy. Semipalatinsk is grown in the dry interior of America and is spreading in its habit of growth. Kansas is very similar to our Tamworth strain, and has very broad leaves. Bathurst Nos. 6 and 9 (selections from Tamworth strain) still continue to give good results. In addition to the varieties above mentioned, seed from eighteen selections of Hunter River lucerne, three from Tamworth, and four from Montana have been planted this season.

No irrigation work is being carried out with any of the above-mentioned varieties and strains, in order to see how they yield under ordinary rainfall conditions.

At Cowra Experiment Farm plots of Bathurst Nos. 6 and 9, Montana, Grimm, and Tamworth have been established. This season, plots of Semipalatinsk, China, and selected strains from Tamworth variety have also been sown. At Glen Innes the two imported varieties of special interest are Grimm and Montana. The former has given excellent results in the United States as the most superior alfalfa in respect to winter hardiness. Montana is also an excellent frost resister, and the climate of the cold regions of New South Wales seems to suit this variety better than the Grimm type. As our winters are not as harsh as those of America, Grimm is not required to exhibit fully its special characteristic—that is, its winter hardiness.

Pollination of Lucerne.

Various theories have been put forward as to the work insects perform in the pollination of the lucerne flower, and it is often stated by growers that "unless the bees are working freely in a lucerne crop intended for seed purposes, very little seed will set." This statement seems to be substantiated in a measure by fact. By virtue of its peculiar design, the lucerne flower "trips" or explodes at a certain stage of maturity, and though this occurs naturally in some flowers it is much more often brought about artificially through the intervention of insects. The tripping of the flower allows the pistil to clear itself of its surrounding boat-like structure, known as the "keel," which consists of two petals joined together. Fertilisation may take place in some cases in untripped flowers, though experiments have shown that cross-pollination is much more effective than self-pollination.

Climatic conditions have considerable bearing on the production of seed. If heavy rain falls during the pollinating period very little seed will form; cold weather has a somewhat similar effect, and very little natural tripping of the flower takes place when low temperatures prevail. Lucerne sets seed freely (in suitable weather) when there is a comparative shortage in the moisture supply at the final stages of growth. On irrigated land, it is the general practice to apply a rather smaller quantity of water to a crop intended for seed purposes than that usually given to a hay crop.

Testing for Vitality and Purity.

Owing to the high rates ruling in most years for lucerne seed, a prospective grower should make it his business to test samples of the seed available before purchasing the amount required for sowing his field. Each sample should first of all be examined for weed seeds and other impurities, and after these have been calculated, 100 lucerne seeds from each sample should be put down separately for a germination test.

To carry out the test, take a piece of blotting paper about 6 by 8 inches in size, folded across the middle, and place on an ordinary dinner plate. Moisten the blotting paper with water, and spread the seeds evenly over one half of the paper; turn the top flap down, and invert another dinner plate over the lower one so as to serve as a cover. The plates should then be set in a warm place, where the temperature can be approximately maintained at about 80 degrees Fah. The blotting paper must not be allowed to become dry, and every twenty-four hours the germinated seeds should be removed and the number recorded.

In a good sample at least 60 per cent. of the seed should germinate in three days. The test should be maintained for five to six days. An average sample of lucerne seed should give a vitality test of from 80 to 85 per cent., with a purity percentage of at least 98.

It Pays to use Good Seed.

In the best of the lucerne-growing districts of New South Wales the general rate of seeding is 15 lb. per acre, and as much as 20 lb. is applied by some growers. The idea of a heavy seeding is to crowd the plants in order

to obtain a fine-stemmed crop for hay. As the price of good quality lucerne seed in most years ranges between 1s. 6d. and 2s. per lb., this points to the advisability of obtaining seed of good vitality and purity.

Germination tests in the Department's laboratory extending over a number of years show an average of 80 per cent. This figure does not take into account the hard seeds in a sample. It is the practice in America to add one-third of the number of hard seeds in a sample to the germination test. The seed-coats of these hard seeds prevent them from taking up water readily, but if they are scratched before planting it will be found that the majority of them will germinate when sown. A proportion of them will germinate even if they are not treated in the manner indicated.

The question of the treatment of hard seeds is being investigated at the present time. In the United States a considerable amount of lucerne and clover seed is passed through a scarifying machine before sowing in order to scratch the seed-coats; the seed is blown over a rough surface (generally sand-paper), and no damage to the seed results from the process. Our own tests show that remarkable results are obtainable by lightly rubbing the seed on a rough surface, such as that of an ordinary fine brick. The results tabulated below were obtained in three tests which are not yet completed. The hard seeds used were obtained by putting a number of seeds on moistened blotting-paper, as for a germination test, and later picking out those that showed no signs of swelling, having obviously failed to absorb moisture. These tests are being continued in order to obtain data as to the length of time the untreated seeds, which failed to germinate after fourteen days in the germination chamber, will take to germinate after being allowed to dry and sown in soil.

	Hard seed—not scratched.					Hard seed—scratched.				
	Percentage of germination.				Total in 7 days.	Percentage of germination.				Total in 7 days.
	4 days.	5 days.	6 days.	7 days.		4 days.	5 days.	6 days.	7 days.	
Sample 1 ...	12	...	...	4	16	96	...	...	...	96
,, 2 ...	0	...	...	20	20	70	...	...	...	70
,, 3 ...	4	...	...	...	4	80	...	...	4	84

The results to date are interesting from the point of view of rapidity of germination. This is one of the most important factors for the farmer to consider, as a protracted germination period of any class of seed means an uneven crop.

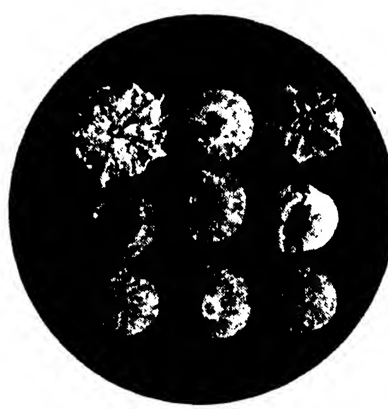
Common Weed Seeds found in Lucerne.

The common weed seeds found in locally-grown, Victorian, and imported samples of lucerne seed are given below. These particulars have been obtained from the seed-testing laboratory's records. It will be seen that a fairly high standard of purity has been maintained by lucerne seed growers and also by importers.

Cockspur or Maltese Thistle Seed
(*Centaurea melitensis*). X 5

Rib Grass or Lamb's Tongue Seed
(*Plantago lanceolata*). X 5.

Black Thistle Seed
Carduus lanceolatus). X 5.

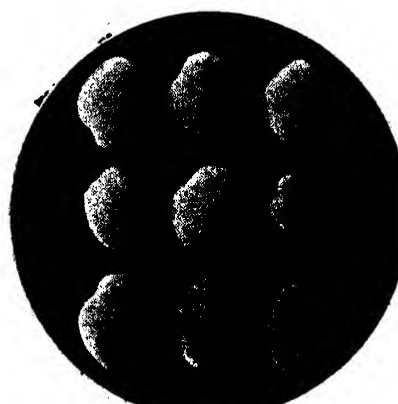


Fat Hen Seed
(*Chenopodium album*). X 8.

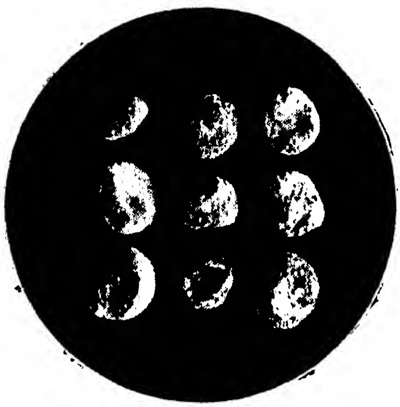
Seed of Pigeon Grass
(*Setaria viridis*). X 8.

Paspalum Seed
(*Paspalum dilatatum*). X 5.

Couch Grass Seed
(*Cynodon dactylon*). X 8.

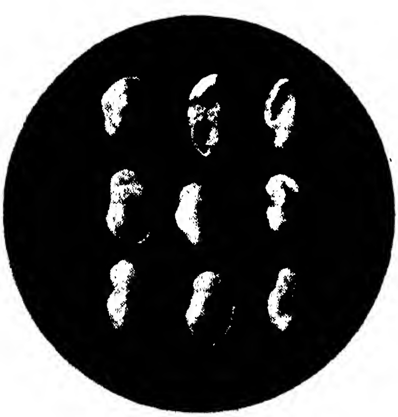


Hexham Scent Seed
(*Melilotus parviflora*). X 8.



Dodder Seed
(*Cuscuta trifolii*). **X 10.**

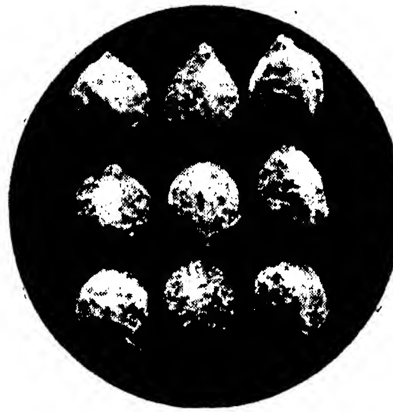
Shrivelled Lucerne Seed. X 5.



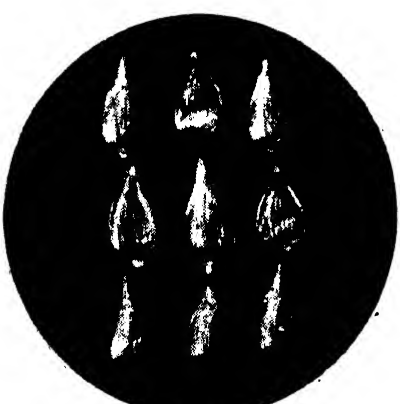
Hard Lucerne Seed.
Even though left in the germination chamber for five weeks, these seeds did not germinate.
X 5.

Lucerne Seed. X 5.

Wire or Knot Weed Seed
(*Polygonum aviculare*). X 8.



Sheep's Sorrel Seed in the husk
(*Rumex acetosella*).
The shelled seed is somewhat similar in shape to Curled Dock Seed, but much smaller.
X 10.



Seed of a Sedge
(*Carex paniculata*). X 5.

Curled Dock Seed
(*Rumex crispus*). X 8.

PURITY Tests of samples of Locally-grown, Victorian, and Imported Seed.

Source of Supply.	Year received for Test.	Pure Seed per cent.	Foreign Seed per cent.	Kind and Number of Foreign Seeds in one pound of Lucerne Seed.	Remarks.
South Africa	1915	99·85	·15	*Polygonum aviculare* (Wire or Knot Weed) 160 *Chenopodium album* (Fat Hen) ... ... 96 *Bromus* sp. (Brome Grass)... ... ... 80 *Rumex* sp. (Docks) 16	A fairly clean sample of seed.
" ...	"	99·56	·44	*Chenopodium album* (Fat Hen) ... ... 800 *Polygonum aviculare* (Wire or Knot Weed) 128 *Rumex* sp. (Docks) ... ... 96 *Malva parviflora* (Small-flowered Mallow) 32	A large percentage of immature seed present.
" ...	"	99·91	·09	*Chenopodium album* (Fat Hen) ... ... 192 *Malva parviflora* (Small-flowered Mallow) 32	A fairly clean sample of seed.
" ...	"	99·95	·05	*Polygonum aviculare* (Wire or Knot Weed) 64 *Chenopodium album* (Fat Hen) 64	" "
" ...	"	99·80	·20	*Chenopodium album* (Fat Hen) ... ... 320 *Polygonum aviculare* (Wire or Knot Weed) 80 *Melilotus parviflora* (Hexham Scent) ... 48 *Rumex crispus* (Curled Dock) 32	" "
United States	1916	99·15	·85	*Trifolium pratense* (Red Clover) ... ... 832 *Phleum pratense* (Timothy Grass)... ... 512 *Trifolium fragiferum* (Strawberry Clover) 320 *Setaria* sp. (a Pigeon Grass) ... ... 192 *Chenopodium album* (Fat Hen) 192	A large percentage of shrivelled seed present.
South Africa	"	99·92	·08	*Polygonum aviculare* (Wire or Knot Weed) 96 *Chenopodium album* (Fat Hen) ... ... 64 *Gramineæ* (Grasses)... 32	A fairly clean sample of seed.
" ...	1917	86·37	1·63 (*12·00)	*Ammi majus* (Bishop's Weed) ... 2, 560 *Chenopodium album* (Fat Hen) ... ... 640 *Panicum* sp. (Panic Grass) ... ... 480 *Polygonum aviculare* (Wire or Knot Weed) 128 *Stellaria media* (Chick-weed) 96	A fairly large percentage of weeds present, and also a lot of dirt. These would detract considerably from the value of sample.
" ...	"	99·86	·14	*Plantago lanceolata* (Lamb's Tongue) ... 224 *Rumex* sp. (Docks) 112	A fairly clean sample of seed.
United States	"	99·95	·05	*Medicago maculata* (Spotted Medick) ... 64 *Trifolium pratense* (Red Clover) ... ... 32 *Chenopodium album* (Fat Hen) 32	Containing two useful classes of plants, and one detrimental.
South Africa	1918	99·92	·08	*Cuscuta Trifolii* (Dodder) ... ... 64 *Rumex* sp. (Docks) ... ... 64 *Polygonum aviculare* (Wire or Knot Weed) 64	Unfit for sowing owing to the presence of dodder.
New South Wales.	1915	93·7	6·3	*Plantago lanceolata* (Lamb's Tongue) 11,000 *Setaria glauca* (a Pigeon Grass) ... 1,700 *Setaria viridis* (a Pigeon Grass)) ... 1,500 *Picris echioides* (Ox Tongue) ... ... 600 *Rumex crispus* (Curled Dock) ... ... 64 *Chenopodium album* (Fat Hen) 64	A very dirty sample. Lucerne seed irregular in size many seeds shrunken in appearance.
" ...	"	99·95	·05	*Rumex* sp. (Docks) 128	Fairly clean sample.
" ...	1916	91·0	5·0 (*4·0)	*Eragrostis major* (Stink Grass) ... 7,040 *Verbena officinalis* (Vervein or Blue-top) 1,920 *Chenopodium album* (Fat Hen) ... 1,280 *Polygonum aviculare* (Wire or Knot Weed) 640 *Panicum capillare* (Hair-stalked Panic Grass). 640 *Lepidium ruderale* (Pepper-weed) ... 512	Unfit for sowing. This sample was sold as good second grade lucerne seed.
" ...	1917	88·0	12·0	*Polygonum aviculare* (Wire or Knot Weed) ... ... 26,880 *Apium Leptophyllum* (Wild Parsley) ... 64 *Verbena officinalis* (Vervein or Blue-top) ... 64 *Panicum* sp. (Panic grasses) 64	Unfit for sowing.

* Inert matter (dirt).

PURITY Tests of samples of Seed—*continued.*

Source of Supply.	Year received for Test.	Pure Seed per cent.	Foreign Seed per cent.	Kind and Number of Foreign Seeds in one pound of Lucerne Seed.	Remarks.
New South Wales.	1918	98·5	1·5	*Glycine clandestina* ... ... 3,200 *Convolvulaceæ* ... ... 384 *Chenopodium album* (Fat Hen) 192	*Glycine clandestina* is a creeping vine and likely to become troublesome, as a large quantity of its seed is present.
" ...	"	99·86	·14	*Chenopodium album* (Fat Hen) ... ... 128 *Polygonum aviculare* (Wire or Knot Weed) 128 *Melilotus parviflora* (Hexham Scent) ... 64	A fair quantity of shrivelled lucerne seed in sample.
" ...	"	94·7	5·3	*Panicum capillare* (Hair-stalked Panic Grass). 11,200 *Verbena officinalis* (Vervein or Blue-top) 1,600	Unfit for sowing.
" ...	1919	99·57	·43	*Chenopodium album* (Fat Hen) ... ... 576 *Polygonum aviculare* (Wire or Knot Weed) 384 *Melilotus parviflora* (Hexham Scent) ... 64	Fat hen and knot weed fairly plentiful.
" ...	"	99·57	·96	*Chenopodium album* (Fat Hen) ... 1,920 *Polygonum aviculare* (Wire or Knot Weed) 320 *Rumex* sp. (Docks) 64	" "
" ...	"	99·92	·08	*Rumex crispus* (Curled Dock) ... ... 128 *Melilotus parviflora* (Hexham Scent) ... 64	A fairly clean sample.
" ...	1920	98·45	1·55	*Chenopodium album* (Fat Hen) ... 3,648 *Setaria viridis* (a Pigeon Grass) 64	A large quantity of fat hen present.
Victoria ...	"	99·93	·07	*Phalaris canariensis* (a Canary Grass) ... 32 *Lolium perenne* (Perennial Rye-grass) ... 32 *Centaurea melitensis* (Cockspur Thistle) ... 32 *Carduus lanceolatus* (Black Thistle) ... 32 *Scirpus maritimus* (Seaside Club Rush) ... 32	The two thistles and the rush are bad weeds if they become established.
" ...	"	99·41	·59	*Plantago lanceolata* (Lamb's Tongue) ... 864 *Setaria viridis* (a Pigeon Grass) ... ... 256 *Chenopodium album* (Fat Hen) ... ... 64 *Rumex* sp. (Docks) ... ... 32 *Picris echioides* (Ox Tongue) ... ... 32 *Prunella vulgaris* (Self-heal) ... ... 32 *Ammi majus* (Bishop's Weed) ... ... 32 *Rudbeckia hirta* (Hairy Cone-flower) ... 32 *Salvia verbenacea* (Wild Sage) ... ... 32 *Gramineæ* (Grasses) 32	A varied collection of weed seeds, although only a few of each.
" ...	"	99·93	·07	*Carex paniculata* (a Sedge) ... ... 96 *Amaranthus retroflectus* (Reflexed Amaranth) 32 *Chenopodium album* (Fat Hen) 32	A fairly clean sample.

Our import regulations do not deal with the question of the vitality of seed samples, which is to be regretted. The regulations cover the question of the purity of the seed imported, and the quarantine authorities can and do compel the importers to have dirty samples cleaned in order to remove weed seeds and other foreign matter before submitting them for sale. It is quite a simple matter, however, for the purchaser of any class of seed to carry out a vitality (germination) test, and this should invariably be done. Especially is this necessary (as has been pointed out previously) in the case of lucerne seed, as a high price per pound is invariably charged, and a heavy seeding per acre is carried out on first-class lucerne land.

The Department of Agriculture will at any time carry out both purity and vitality tests of all classes of seed free of charge for *bona fide* farmers.

Harmful Effect of Weeds and Grasses.

When a good sample of hay or seed is to be produced, the lucerne crop must be free of weeds and grasses. Among the worst weeds a grower has to contend with are dodder (*Cuscuta* sp.), wire or knot weed (*Polygonum aviculare*), fat hen (*Chenopodium album*), dock (*Rumex* sp.), and all thistles. Couch grass (*Cynodon dactylon*), paspalum (*Paspalum dilatatum*) and water couch (*Paspalum distichum*), are three of the very worst pests in a lucerne field, as they not only crowd the plants out but cause considerable trouble to the mowing machine in taking the edge off the knife and in choking up the fingers of the cutter-bar. Where the hay is to be consumed on the farm, a certain amount of good grasses incorporated in the product will not affect the feeding value of the sample to any appreciable degree, but the presence of foreign material in a sample baled for market will decrease the monetary return considerably.

We look for the first two or three cuts from a new lucerne field to contain a fair quantity of weed plants, as the weed seeds present in the soil germinate when the seed-bed has been prepared. If the areas are small they should be cut with a scythe, *before the weed plants form seed*, in order to get close to the ground so as to cut all low growing weeds. On large areas the cutter-bar of the mowing machine should be set as close to the ground as possible, care being taken, however, not to tear the young lucerne plants out of the ground.

Seeding in the Drier Districts.

On large areas the seed is generally sown through the grass seed attachment of the wheat drill, or mixed with manure and sown through the manure box. Six to eight pounds of seed are sufficient to apply per acre. It must be remembered that lucerne seed (being very small) requires to be lightly covered, and consequently the hoes or discs of the drill should be fixed in such a way that they are out of the ground when the drill is in gear, so as to ensure the seed being sown on the surface of the ground. Remove the spiral ribbon seed and manure conductors from the drill, in order that the material will be broadcasted over the field.

A chain or a few bushes attached to the footboard of the drill will give the necessary amount of soil covering for the seed. Where it is intended to carry out the work of raising lucerne seed on medium-class land in the drier parts of the State, it is advisable to grow the crop in drills 30 to 36 inches apart, using 1½ to 2 lb. of seed per acre.

Harvesting the Seed Crop.

To determine the correct time to harvest for seed requires the exercise of a considerable amount of judgment. The December cutting is generally selected for seed purposes, and should be harvested when the majority of the pods are yellow. Should the crop be left until the majority of the pods are brown, a large quantity of seed will be shed. In very hot districts an earlier or later cutting than the December one may be taken, as the flowers are not so likely to suffer from wilting due to very high temperatures.

The harvesting of the seed crop requires to be carefully carried out, as rough handling will result in a loss of seed. When harvesting small areas, cut the crop with a scythe, as the material will then be carefully handled and is left in neat swaths. Where a mower is used, a swath-board should be attached in order to leave the crop in wind-rows. The swaths or wind-rows are later *drawn* into heaps with a pitchfork. Less shattering of the seed occurs when the crop is cocked while the material is still on the sappy side than when handled in a dry condition.

If a reaper and binder is used for harvesting a seed crop, the bundles or sheaves must be stooked and allowed to become thoroughly dry before stacking and threshing; or the machine may be adjusted so as not to bind the crop, simply allowing the cut material to be dropped into heaps by means of the sheaf carrier. A certain amount of seed is likely to be lost where the binder is used, as some of the pods are likely to be knocked off when the crop is passing over the elevators.

From five to ten days (according to weather conditions) will be necessary for the crop to become thoroughly dry before stacking or threshing. If rain falls on the cut crop, the cocks will require to be turned a couple of times to allow of thorough drying. Rain will cause the seed of a cut crop to become discoloured, seed pods to burst and shatter, and the crop to heat if stacked while damp, thus affecting the vitality of the seed.

Threshing and Stacking.

Particular care requires to be exercised in handling the seed crop when it is ready for stacking or threshing, as the pods are dry and the seed shatters easily. Strong cloth sheets, tarpaulins, or corn bags sown together, should be used to cover the bed of the dray or waggon, in order to collect any seed which falls during the process of loading. If the cocks have been made small, they can be easily and carefully handled with the pitchfork when loading, unloading, and stacking.

The stack should be made in a similar manner to that for lucerne hay, building it with a good foundation of straw so as to keep the lucerne seed crop from directly resting on the ground. Very little tramping of the stack should be done, and when completed the top of the stack should be well covered with tarpaulin or sheets of iron, etc., to prevent rain entering.

Small quantities are threshed with a flail. Up-to-date grain threshers may, in most cases, be fitted with special lucerne sieves, but where seed-raising is gone in for extensively a lucerne seed thresher is generally available for dealing with the crop.

Four to eight bushels of seed are obtained in a good season on good quality lucerne land; on medium class land, two to three bushels.

WE have found that the sprays (resin soda or washing soda) which will kill white wax will also kill pink wax. Being harder than white wax, this scale does not seal down to the wood as closely, and the spray penetrates underneath more easily.—W. J. ALLEN.

The Neutralisation of Cream.

Mixed Lime and Bicarbonate of Soda as an Agent.

L. T. MacINNES, Dairy Expert.

In the June issue of the *Agricultural Gazette* it was stated that experiments in the neutralisation of cream with a mixture of lime and bicarbonate of soda were in progress. Two of these experiments, one under the flash method of pasteurising and the other under the holding method, have since been completed on the North Coast by Mr. O. C. Ballhausen, Dairy Instructor. Mr. Ballhausen, in reporting upon the results, states that far better ones would have been obtained if the lime used had not been so gritty. In both experiments a portion of the lime remained in small hard lumps about twice the size of a pin's head, and no reasonable amount of stirring in hot water would break them down. This would affect the neutralising powers of the mixture, and was doubtless responsible for the acidity only being reduced to ·26 when ·2 was aimed at.

The neutralising agent in both instances was mixed in Sydney, equal weights of bicarbonate of soda and lime being used. The quantity was divided into two nearly equal amounts, and analyses of these were made by the Chemist, it being ascertained that one gram of the mixture would neutralise 1·3137 grams lactic acid. One whole packet would therefore neutralise 5,458 lb. lactic acid, or in other words, would reduce the acidity of 5,458 lb. cream 0·1 per cent.

The first experiment was carried out at the Kyogle Co-operative Dairy Company's central factory, where the holding method of pasteurising is in use. The cream used for the experiment was graded to score 44 points out of a possible 50 for flavour, and was equal to making a good choicest quality butter The amount of cream experimented with barely half-filled one pasteuriser vat, so that the mixing of the neutralising agent and the aeration of the cream must have been exceedingly well carried out. The addition of the neutraliser to the cream had apparently no effect on its viscosity, and in this regard, so far as could be observed during the action of the pasteuriser, its effect differed in no way from that of bicarbonate of soda alone. This absence of viscosity applied right up to the time when the cream was delivered into the churns. The following are the details connected with this experiment:—

Quantity of cream treated	2,233 lb.
Acidity of cream before neutralising	·41 per cent.
Amount of mixture added	38 oz.
Temperature of cream when mixture was added	90 to 95 deg. Fah
Acidity of cream before pasteurising and after neutralising	·37 per cent.
Acidity of cream 30 minutes later, when at 145 deg. Fah.	·34 ,,
Time cream was held at 145 deg. Fah.	20 minutes
Acidity of cream 15 minutes after cooling commenced ...	·32 per cent.
,, ,, 30 ,, ,, ,, ...	·315 ,,
,, ,, 60 ,, ,, ,, ..	·306 ,,
,, ,, 120 ,, ,, ,, ...	·287 ,,
,, ,, when churned 12 hours after pasteurising	·3 ,,

Butter made from this cream when packed was free from lime or soda flavour, but was somewhat flat. A box of this butter was specially marked and forwarded to Sydney for official grading by the State grader, and was examined on 18th May, one week after manufacture, when it scored 43 points for flavour, 30 points for body and texture, 20 points for packing, finish and colour; total, 93 points. The flavour was noted as slightly flat but clean, choicest quality. It will be noted that full points were scored for manufacture and finish.

The second experiment was carried out at the North Coast Co-operative Company's branch factory at Lismore, where the flash method of pasteurising is employed. The neutralising agent was similar to that used at Kyogle. The effect of this mixture on the cream differed in no way from that in the experiment at Kyogle factory. In this case, also, hard lumps of lime would not dissolve, and this would account for the acidity being reduced to only ·261 per cent. when ·2 per cent. was aimed at. Cream treated graded 43 points for flavour prior to pasteurising, and the butter made from it when packed had neither lime nor soda flavour. Although the cream came from the pasteuriser with an acidity of ·288 per cent. no curdling was noticeable, nor was the flavour affected.

It was noted that with mixed lime and bicarbonate of soda the amount of froth which was formed in the cream was considerably less than when bicarbonate of soda is used alone. The following are particulars of this experiment:—

Quantity of cream treated	... ...	2,400 lb.	
Amount of mixture used	... ...	39 oz.	
Acidity of cream before pasteurising ...	...	·396	per cent.
,, ,, coming from pasteuriser	...	·288	,,
,, ,, 15 minutes after ...	...	·279	,,
,, ,, 30 ,, ,, ...	...	·279	,,
,, ,, 60 ,, ,, ...	...	·261	,,
,, ,, 120 ,, ,, ...	...	·270	,,
,, ,, 12 hours after pasteurising		·288	,,

Butter made from this cream was despatched to Sydney and specially examined by the State grader, who gave it a good 93 points, or choicest quality. The flavour showed no sign of alkalinity.

Further experiments will be carried out, when a more soluble lime will be used, but, so far as the work has gone, factories can safely use a mixture of bicarbonate of soda and lime in equal proportions.

Two advantages have been obtained by using the mixture:—

1. In the case of the holding method of pasteurising, there is less viscosity than when lime is used alone.
2. In the case of the flash method there is less froth than when soda is used alone.

In both the experiments carried out, Mr. Balhausen personally supervised the whole of the work and took all the acidity tests himself.

Safeguarding Farm Stock from Disease.

(5) By Preventing Parasitic Infestation.

MAX HENRY, M.R.C.V.S., B.V.Sc.

Both external and internal parasites at times lead to severe disease and mortality among all classes of stock. The former class includes ticks, lice, keds, and mange parasites ; the latter, worms, fluke and bots. It is not in most cases possible to prevent a first infestation, but we are not entirely helpless in this respect as regards some at least of these pests.

Ticks produce disease in two ways—the cattle tick and fowl tick by inoculating animals and birds with organisms causing disease, and various scrub ticks presumably by some toxin which they introduce into the animal. Cattle affected with tick are usually dipped, and the effect of the dipping material that remains on the animal may prevent a re-infestation for a brief period. The fowl tick may be destroyed and infestation prevented by spraying the interior of fowl-houses, roosts, &c., with kerosene emulsion ; the presence of the tick may also be discouraged by erecting fowl-houses of sound material, which will not provide cracks and crannies in which the ticks may conceal themselves during the day. Lice and keds (commonly known as sheep tick) on sheep lead to serious loss in the condition of the animal and a lowering of the quality of its wool; the attacks of these parasites also may be prevented for a short time as a result of dipping. Flies will be prevented for a short time from "striking" sheep by such measures as crutching, dipping, spraying, and jetting, but again the effect is not permanent.

Certain general measures of good management go far to prevent infestation with lice, mange parasites and other pests, and of such measures the chief are as follows :—(1) The building of pigsties, stables, cow-sheds, and calf-pens with sound material which does not afford cover and lodgement for parasites ; (2) the maintenance of all such buildings in a thoroughly clean condition, and the admission of ample light and sunshine ; (3) the regular and thorough grooming of horses and cows and the washing of pigs ; (4) the prevention of overcrowding, particularly of pigs and calves ; (5) the isolation of infected animals ; (6) the cleaning of grooming gear ; and (7) the inspection of stock before purchase by the buyer.

The destruction of parasites, particularly of flies, by any means is of course of value. It is not easy to find any measure which will prevent infestation by bots, though if the eggs are noted on the horse they may be dealt with by singeing. Some permanent benefit may be effected in the way of preventing the attacks of worms and fluke. These latter parasites all require moisture for their full development ; they mostly pass portion of their lives on the ground, and some, notably fluke, require to pass through another animal before they can again attack their first host. The measures that are often of value against them may be summarised in a few paragraphs.

Draining of Swampy Areas.—This is often held to be impracticable or not worth its cost, but in not a few cases the labour and expense involved will be more than repaid by the freedom of the stock from pests and disease. The snails which harbour fluke will be reduced in numbers or got rid of, and the surroundings rendered less suitable to other parasites for the completion of their life cycle.

Fencing off of Ponds.—The fencing off of ponds with marshy surroundings and the watering of stock from troughs with well water is another important measure. It is not the water itself which is dangerous but the swampy ground that so often surrounds such watering places.

Subdivision of Paddocks.—It may be held that subdivision and resting of paddocks will involve the crowding together of stock, with consequent increase in the chance of infestation, but while this is true to some extent, such an effect is probably more than counterbalanced in two ways. Firstly, there is a limit to the length of time for which these parasites can exist on the ground, and although it is not possible to name a definite period it is obvious that the longer the paddocks are rested the greater the number of parasites that will die. Secondly, the increased feeding value of the pasture will assist the stock to resist parasites.

Change of Stock.—The feeding of different classes of stock on infested or suspected country is another means of protection. Many of the parasites most destructive to a particular animal cannot live in others and consequently, where it can be managed, a change of stock will lead to a considerable reduction in the number of parasites present.

Avoidance of Overcrowding.—Avoidance of overcrowding in sour, swampy paddocks is of particular importance when large numbers of young animals, such as calves, are concerned. Examples of the ill-effects of overcrowding are often seen, especially when drought forces large numbers on to poor coastal lands.

Cultivation.—There can be no doubt that when practicable, the effect of cultivating the ground must be greatly to reduce the numbers of parasites present. In many instances this might be the soundest method of dealing with seriously infested paddocks.

Treatment of the Hosts.—By this is meant the keeping away or treatment of certain definite hosts of particular parasites. For instance, in districts where hydatids are common, or in the neighbourhood of slaughter-houses, dogs should, if possible, be prevented from eating affected portions of carcases lest they become infested with tapeworms, which, in turn, leads to the infestation of men, cattle, and sheep with hydatids. The treatment of dogs periodically with worm medicine is also of value. In this connection the destruction of carcases is of importance.

Where parasitic infestation has taken place, measures must be taken to deal with the parasite in the animal, but before anything in the nature of treatment is suggested, the wonderful effect of good food in safeguarding the animal from the ill effects of parasitic attacks must once more be urged. In very few

cases can the administration of drugs compete with good feeding. The routine drenching of sheep in wormy districts with a reliable vermicide will have very good effects, but two things must be borne in mind—(1) the drenching should not be delayed until the sheep are badly pulled down or dying, but should be carried out as soon as it is known that they are so affected as to be likely to be harmed; and (2) a single drenching is often insufficient, and, where numbers make it practicable, it should be repeated at a suitable interval. Except in the case of calves, it is seldom necessary to employ such measures with cattle, but horses are frequently benefited by this line of treatment. Not only debility in horses, but colic as well is often due to the presence of worms, and a timely dose of worm medicine may have great preventive value.

The prevention of debility, irritation, and loss of wool from external parasites in sheep can only be dealt with by dipping, and the time appears to be fast approaching in many sheep districts when dipping will be as much a routine matter as shearing. Debility in cattle from tick worry can also only be effectively prevented by frequent dipping.

In concluding these notes on the prevention of disease, the duty of supporting the Department of Agriculture in its attempts to control infectious disease must be urged. It is altogether in the interests of the stockowner immediately concerned, and still more so of his neighbours, to report such infectious diseases as pleuro-pneumonia and anthrax as soon as possible. Delay nearly always means further infection of the stock and heavier losses.

It may, perhaps, be again advisable to point out that while many of the measures suggested in these articles are impracticable on large holdings, they are all practicable in some set of conditions or another, and it is essential that measures should be considered which will be applicable to the conditions which the increasing tendency to closer settlement is steadily making more general. Past methods, based solely on the conditions existent in the days of large holdings, will presently be of very little value for most of the State.

Trying a Tractor.

Last year's report demonstrated that even machines of the same make could not be effectively compared and contrasted under the present trial regulations. The statistics showed that identical machines ploughed altogether different acreages per hour at different cost for fuel. From this fact it may be hazarded that if similar machines underwent a similar trial to-day, a series of results would be obtained substantially different from those recorded last year. Apart from these considerations, it must be emphasised that a test of a carefully tuned machine over a few days only, and in the hands of an expert operator, affords no criterion whatever of the reliability or the durability of a machine in farming practice; and if this is not demonstrated any test is robbed of the greater part of its value.—H. G. Richardson in *The Journal of the Ministry of Agriculture*, England.

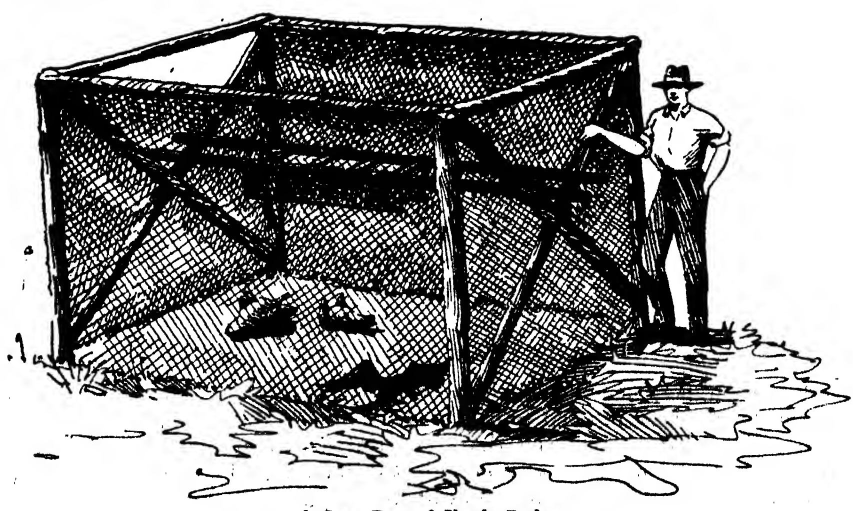
AN EFFECTIVE CROW TRAP.

THE accompanying drawing gives the construction of a crow trap supplied by Mr. O. H. Carter, of Linton, Barraba. It consists of a wire netted frame, about 9 feet long, with posts 7 feet out of the ground, and supports crossed diagonally at each end. A ladder is placed from end to end, resting on the supports near their intersection. The rungs of the ladder are 8 inches apart, and the ladder itself 9 inches wide. The timber used is bush timber, with the bark left on.

When netting in the trap, 2-inch wire-netting is attached to the frame at the ground on one side, and carried up over the top rail. It is then brought down under the ladder and up and over the top rail on the other side, and so to the ground. The ends are then netted in, as shown in the figure. A cut is now made in the wire along the centre of the ladder, the length of the centre three or four rungs, and two other cuts crossways at the ends of the first cut, so that the wire hangs down from the sides of the ladder, leaving a fair-sized opening, crossed by the several rungs.

The crow, attracted by the sheep's head or other suitable bait deposited on the floor of the trap, lands on the ladder, and then descends through the opening. The trap is said to be thoroughly efficient, several crows being caught within a short time.

The trap shown is of large size, but a few pastoralists who have made the trap have found it acts better if the drop from the ladder to the ground is not too great, the crows being frightened if they cannot reach the bait quite easily. If the netting is left only bent down and not turned too sharply, the crows will never find their way out.—C. J. WOOLLETT, Stock Inspector, Tamworth.



A Crow Trap of Simple Design.

No other legume can be grown so successfully and on such a variety of soils under adverse conditions as the cowpea. A very rich soil is not conducive to the best results with the crop. Good maize land is considered particularly favourable.—*Weekly News Letter.*

The Pruning of the Vine.

[Continued from Vol. XXXI, page 661.]

H. E. LAFFER.

The Bordelais Spalier System.

A SYSTEM more applicable to vines of average strength than those already described is furnished by the Bordelais spalier. It is adapted to all the rod-pruned varieties, and may be utilised for vines of varying degrees of vigour by increasing or decreasing the number of rods which may be left from year to year.

The type consists of a short stem about 12 inches to 15 inches in height, carrying two short arms, which form a more or less pronounced V and has a trellis wire placed 18 inches from the ground. Upon these arms the spurs and rods are situated; the latter, varying in number from two to six, are tied down to the wire on either side of the stem. (See Fig. 18.) The spurs are intended for renewal of fruiting wood from year to year, and therefore need not necessarily be fruit shoots. Strong, well-placed water shoots are preferable to weak or indifferent fruit shoots. The rods are purely fruit bearing, and are renewed annually from the most suitable fruit-bearing canes. To this end it sometimes becomes necessary to make use of a good cane growing from the previous year's rod, when from some cause or other there is a shortage of suitable wood upon the spurs.

Although the height of the stem is set down as from 12 to 15 inches, and that of the wire at 18 inches, these may be varied to suit special circumstances. Generally speaking, however, the height to the first wire need not exceed 2 feet 6 inches. The number of wires is also variable from one to two, and if the second one is adopted it will generally be about 18 inches above the first. In some cases the one wire is considered sufficient, but in others the second is an advantage, in that it serves to support the annual growth in the trailing varieties.

Formation.—Shorten the best cane back to a single spur of two buds the first year. In a large measure the success of the training depends upon making the stem from a good strong cane. Too often one sees the result of bringing a very weak cane up to the wire in order to form the stem, more particularly if the vine is trained at a greater height than that set down in the type. A weak and spindly stem created before the vine has sufficient strength to support it will rarely make up into a strong vine, and in time the whole plant suffers, and it may die, where a stouter vine will pull through.

Second Year.—Assuming that one or more strong canes are available, the stem can be formed, but failing this the vine should again be cut back to a spur. It is a mistake to use a cane which is too weak and short to reach

the wire, and to attach it by a piece of twine. The best plan in such circumstances is to cut right back for this year. When the growth is of good strength, take the best cane, shorten back to the height of the wire, tying vertically and securely in that position. It is a good plan to cut a little on the short side so that the wire has to be depressed a little. The slight strain thus imposed serves to keep the cane rigid and vertical. The topmost internode should be cut right through the node, leaving the enlarged end to prevent the tie from slipping. (See Fig. 19A.) In no case should a live bud be left above the tie, as this would create a strong cane in a useless position.

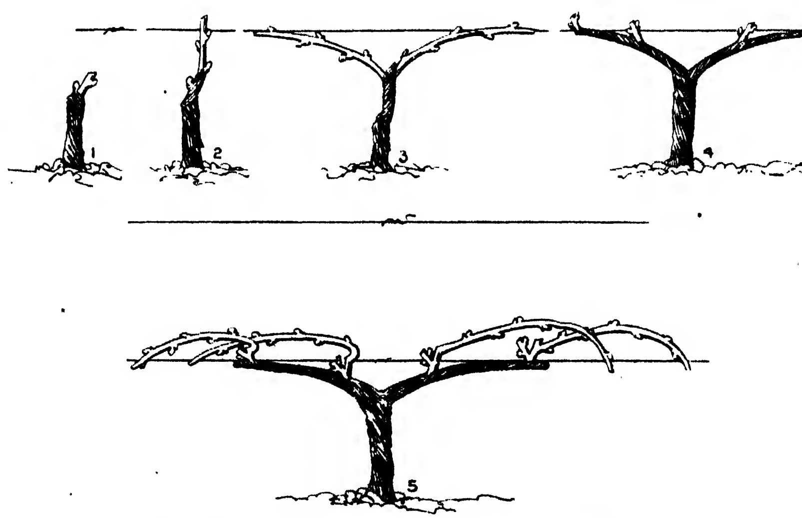


Fig. 18.—Stages in the formation of the Bordelais spalier system.

Third Year.—The vertical stem now carries several canes at varying heights, and from these the two main arms will be formed. The usual plan is to select the two uppermost canes, provided that they suit the purpose, reduce them to a length of 12 to 15 inches, and tie each down to the wire on either side of the stem. The remaining canes are completely removed. This then creates the stem with two main arms, established somewhat in this form:  (See also Fig. 19B.)

It must be remembered that the vine will most likely have carried fruit during the past year, but the tendency to produce fruit to the detriment of wood should be discouraged in the early stages of formation. It may be advisable to reduce the number of canes produced upon the second year's formation to the two which will ultimately be used to create the arms.

Fourth Year.—The two main arms will each be carrying several good canes, and it is from these that the secondary arms will be established. The number will vary with the strength of the vine, and in some cases an addition of one rod upon each arm can be made. Generally speaking, the spurs will be from two to three in number on either arm, but in most cases two will suffice. Should a rod be warranted by reason of great vigour in the vine it will be left at the extremities of the arms and tied down to the wire. It is very unwise to sacrifice the strength of young vines for too much fruit, as the weakening at this stage is rarely recovered. The strongly built young vine is the one which will yield heavy crops over the greatest number of years.

Fifth Year.—The framework of the vine may now be said to be established, and each of the spurs left in the fourth year should be carrying two good strong canes. If a rod has been used as well, its purpose will have

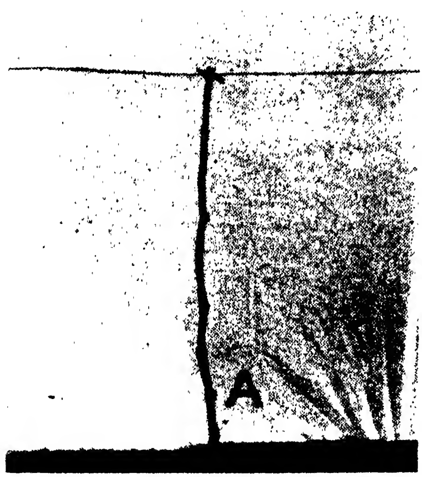


Fig. 19A.—A two-year-old vine cut back and tied to the wire.

been fulfilled, and in the ordinary course of pruning it will be removed. The lower cane on each of the old spurs is shortened back to form a new spur of two buds, and the upper one becomes a new rod. The length of these rods will be adapted to the vigour of the vine, and should not, as a rule, exceed about 18 inches. It may be advisable under certain circumstances to omit the formation of one or more rods. The general rule is that the number of spurs should equal or exceed that of the rods, and their ultimate disposal rests with the judgment of the pruner.

Although the foregoing practically concludes the development of the vine's structure, the system can be extended to meet special conditions. By the extension of the arms in strong vines, the number of spurs and rods can be increased as the occasion may arise.

Annual Pruning.—The annual pruning of the Bordelais spalier consists of the renewal of spurs and rods. The spurs are given preference of

position in so far as they may affect the shape of the vine. In this respect, well placed and vigorous water shoots might be given preference over badly-placed or weak fruit shoots. The rods must, of course, be good fruiting shoots, and their position, so far as they affect the shape of the vine, need not be seriously considered, provided that they do not in any way hamper cultural operations.

It frequently happens that wood for rods, arising from the old spurs, is deficient, and if it is desired to secure extra rods there will usually be found good canes upon the old rods. One or more of these may be utilised as fruiting rods for the time being, and they will be removed in the following season.

As the old secondary arms become worn out, they may be renewed from water shoots suitably placed for the purpose. In time it may be necessary to renew the main arms, and even the stem may, under certain conditions, require renewing. The procedure to be adopted in these cases has been dealt with in a previous article.

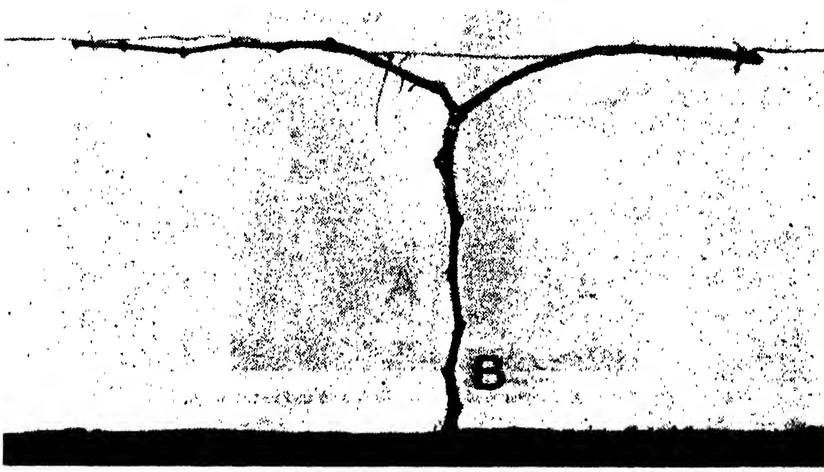


Fig 19B.—A three-year-old vine after pruning showing the two main arms established.

In dealing with the rods the end section should be made through the node, leaving a dead internode for tying to the wire. The practice of leaving a live bud at the end of the rod and tying below it is a mistake, for the reason that this bud, in spite of the ligature below it, usually makes abnormally strong growth at the expense of the intermediate buds.

Twisting and bending the rods when tying them down has a very beneficial influence upon the bursting of the buds. The nearer they approach the horizontal the better do the buds burst as a rule. Secure tying to the wires is important. Twine is most generally used for this purpose, but probably the most useful tie is 26-gauge black wire. The rolls can be cut into lengths suitable for the purpose, and owing to its great pliability it

Fig. 20.—A vine in which the main arms have been started too close to the ground, and which illustrates the results of faulty tying.

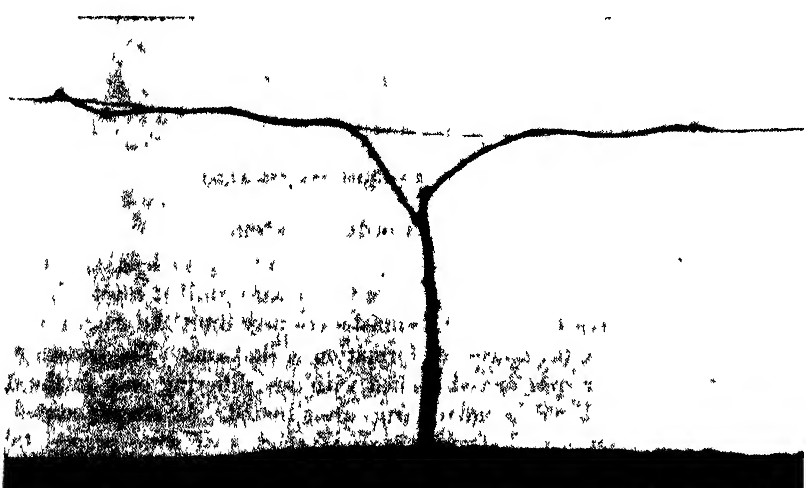


Fig. 21.—The same vine as in Fig. 20 reconstructed with a good stem and two main arms.

can very easily be twisted around the wire and rod. If one turn is first taken around the trellis wire, and the rod then tied to it with about two turns, it will neither slip nor give way during the season. Being black wire, the pieces rust away in the course of two or three years, whereas galvanised wire does not rust, but hangs indefinitely. The evils of bad tying are illustrated in Fig. 20.

The Bordelais spalier system is sometimes adapted to a higher stem, but the formation is practically the same in each stage. A common error is found when the main arms are started too close to the ground, resulting in a very long armed V, as illustrated in Fig. 20. This will ultimately result in a badly furnished vine with all the wood at the summit of bare arms. Fig 21 shows the same vine reconstructed with a good stem and two main arms. When the vines are comparatively young the reconstruction can be effected fairly easily, but where the arms have become too stout, the only hope of remedying the evil is to train a good water shoot into a new stem. By following the steps in formation methodically and tying securely to the trellis wires, the bad results illustrated in Fig. 20 are avoided, and once the stem becomes rigid it supports the weight of the vine against the wind. It then becomes a matter of securely tying the fruiting rods from year to year.

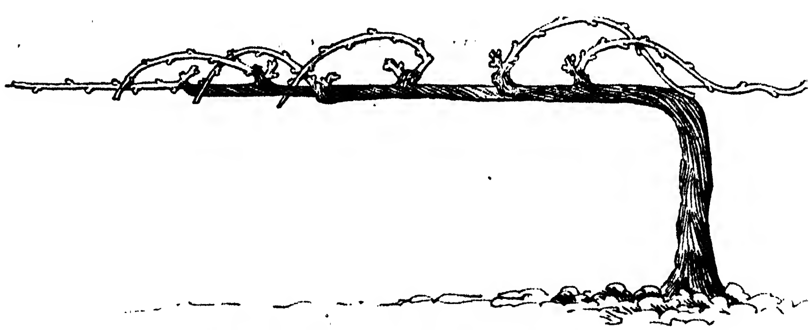


Fig. 22.—A vine trained on Cazenave's cordon system.

Cazenave's Cordon System.

The fully developed type consists of a stem varying in height, with one main arm carried horizontally along the trellis wire until it meets the stem of the next vine (see Fig. 22). Circumstances may limit the length of this arm, but in any case the process of formation is the same. The system may be adapted to either spur or rod pruned varieties, differing only in the distance apart at which the secondary arms are situated. As already stated, it is a system best suited to strong growing varieties of wine grapes, table grapes, and currants.

Formation.—The young vine will be shortened back to a single spur. It is essential that a strong cane shall be secured, sufficiently long to reach the trellis wire, and to admit of a portion of it being laid along the wire. This can only be accomplished by encouraging strong growth in the early stages.

Second Year.—The height at which the stem is to be established very largely determines the treatment in the second year. Where the stem is established at about 20 inches there is no difficulty in securing a cane long enough to reach the first stage of formation. Assuming that such is the case, this cane is drawn up vertically to the wire, and then bent into a horizontal position along the wire. The extent of this horizontal arm depends on the vigour of the vine, but in any case it should not exceed about 2 feet 6 inches. Should the cane be weak it is better to shorten back again for another year.

The end section will be made through a node to facilitate tying, and the terminal bud will be underneath. Permanent twisting of an arm around the wire is not to be recommended, but in order to hold the young arm firmly in position until it has set, a slight twist is a good thing. By the end of a year the twist can easily be taken out, and the arm will retain its position.

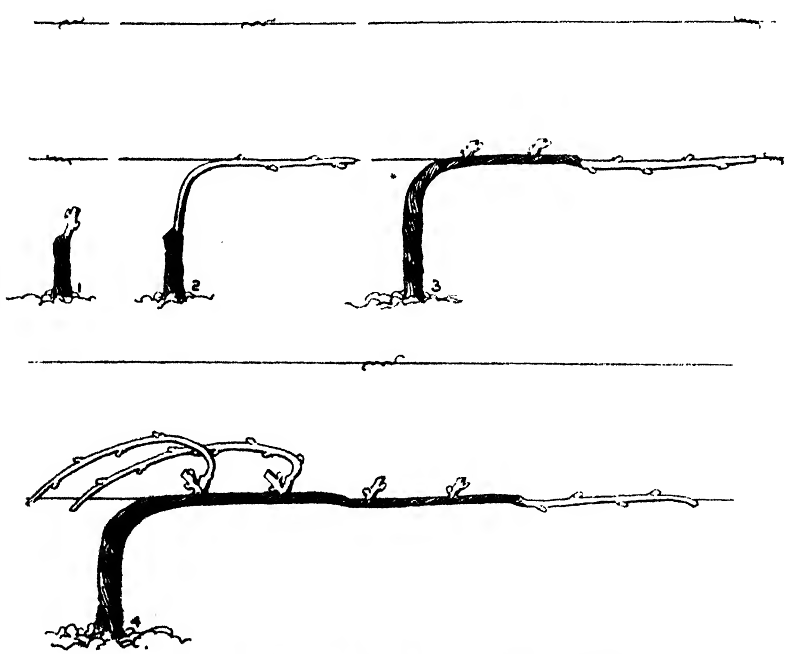


Fig. 22.—Stages in the formation of Cazenave's cordon system.

One important point to be observed in formation is that no shoots are allowed to grow from the stem when once it is established. Further, it is not advisable to allow any canes to develop upon the arm within 12 inches of the bend with the stem. The tendency is for canes in this position to become over strong in relation to those further along. Two courses are open, the better of which is to remove the buds not required at time of pruning, and the other is to disbud the young shoots as they break out in the following spring. The important canes should be tied and protected from injury.

When the vines are being trained at a height of several feet, it becomes necessary to train a cane vertically on a stake, by stages if necessary, and when long enough, to start the main arms as described.

Third Year.—The canes which have grown upon the first section of the main arm will be used to form the secondary arms. The spacing will vary, as in the case of spaliers, being much closer when the vine is to be permanently spur pruned. In this case the spurs may be placed about 6 inches apart, whereas the spacing will be from 12 to 14 inches where the rod and spur are to be employed. The terminal cane will be used to extend the main arm another section, leaving the last bud on the lower side and tying firmly to the wire (see Fig. 23).

Fourth Year.—The development of the secondary arms will be continued. From the canes produced upon the previous year's spurs, renewals will be made, either as spurs only or as combinations of spurs and rods. In the former case the lowest suitable cane will be reduced to a two-bud spur. In the latter the upper cane becomes the rod, while the lower one forms the new spur. The spurs upon the extension are spaced for the continuation of the secondary arms, and at the same time a further extension of the main arm is effected by means of the terminal cane.

Fifth Year and After.—The formation is carried on upon similar lines until the limit of construction has been reached, that is, when the main arm meets the stem of the next vine, or when the vigour of the growth indicates that the limit has been reached. In strong-growing vines there should be no difficulty in carrying the main arm to the stem of the next vine, and it is only in the training of strong-growing vines that this system should be used. Weak-growing varieties, or vines under conditions unlikely to create vigour, should be trained upon some other system such as the bush type or the Bordelais spalier.

Finally, the complete vine has a horizontal main arm furnished with secondary arms, which support the fruit-bearing wood.

Annual Pruning.—The first care is to maintain the vigour of growth by so adjusting the fruiting wood that the strength of the vine is not overtaxed. That is to say, the wood should be of good vigour after the production of a normal crop. Weakness should be met by a reduction in the number of spurs and rods for the time being. As already pointed out, this system is one which necessitates vigour in order to secure best results, and to this end the vines should not be overburdened with spurs and rods. Under conditions of normal vigour the fruiting wood is renewed by the selection of the most suitably-placed canes. When the system is a combined rod and spur the former will be temporarily dispensed with when the growth is abnormally weak. The rods must in all cases be fruit-bearing wood, but the spurs may be established from strong and well-placed water shoots rather than from weak fruit shoots. As the vines become old, renewal of secondary arms will become necessary, and this renovation can be effected by using suitably-placed water shoots.

(*To be continued.*)

Wild Melon Vine (*Cucumis myriocarpus*).

A Cause of Impaction of the Colon.*

MAX HENRY, B.V.Sc., M.R.C.V.S., and H. BELSCHNER.

There grows very plentifully throughout the greater part of the western districts of New South Wales a member of the family *Cucurbitaceæ*, introduced originally from South Africa, and known locally as the wild or paddy melon. It has been identified by the Government Botanist, Mr. J. H. Maiden, F.L.S., as *Cucumis myriocarpus* (Naud).

The plant grows much like any melon or pumpkin vine, sending out long trailing stems, bearing small yellow flowers, and then numerous small melons about three-quarters to one inch in diameter—much like a miniature water melon in appearance, but prickly. They are at first greenish, but turn yellow as they ripen, and are much appreciated by stock in dry times for the moisture they contain. The melons themselves have frequently been accused of causing amaurosis from degeneration of the optic nerve in horses, but so far experimental work has failed to substantiate this.

The plant has very considerable drought-resisting powers, and is frequently the only green thing to be seen in the paddocks. While young it is fairly succulent and comparatively harmless, but when old and commencing to die off the long trailing stems and the leaf stalks are extremely fibrous, and show a very marked tendency to ball in the stomach and intestines, especially when melon forms the greater part or almost all the diet of the animals. Frequent reports have been received of horses dying from eating melon, and in some instances the post-mortem appearances described pointed to impaction of the colon as the cause of death.

Although cursed by horse-owners, the plant is not without its supporters, as during droughty periods, such as are now being experienced, it provides excellent feed for sheep and cattle, which do not appear to suffer from its effects owing, probably, to the remastication. It has, on at least one occasion, been made into silage and fed later with success.

Recently opportunity was offered the writers of observing several cases where the cause and course of the affection could be clearly followed, and curative treatment adopted. The animals affected were young well-bred draught mares in very fair condition, who were at the time in a paddock containing a large quantity of melon, although they had only recently been brought in. The paddock in which they had previously been running had contained some melon, but not a great quantity. The writers are thus unable altogether to agree with Stock Inspector Little, who, writing in the

* From the *Veterinary Journal*, London.

Agricultural Gazette of New South Wales for August, 1915, states that "horses running constantly on melon seldom suffer; when they do it is generally the old animals or those with defective teeth."

There had been on the farm in question rather heavy mortality, which so far had not been satisfactorily explained, and as the country had once had a bad reputation for anthrax, the solution of the question was of some importance. The first case seen was as follows:—

The mare was turned into the melon paddock on Sunday morning, and was then apparently in good health. She was not again seen until midday on Monday, when she was found dead, although the carcase was still warm. There was no discharge from the natural orifices, nor was the body excessively distended with gas. No injury or wound was noticed, except a small fistula of the wither. The subcutaneous tissues were normal, but the blood had not coagulated well and was dark in colour and somewhat sticky. The stomach was filled with water, and was normal save for two spiropteral tumours, each about one inch in diameter. The small intestine was almost empty, and was patchily congested—cæcum normal—large colon very full of a mass of fibrous material mostly composed of the remains of the paddy melon; a few inches from ileo-cæcal valve was a hard, rounded mass, about 9 by 6 inches of the same material. The small colon contained, about a foot from its commencement, a larger mass, very firm, and taking the impress of the colon. Where these masses occurred the intestine was markedly congested. Strongyles were present in fair numbers. There were signs of struggling visible on the ground. The feed in the paddock contained a great deal of melon, and the mare had evidently done her best to fill herself with it, both in this and in her last paddock. It is often said, and with some justification, that certain animals develop a liking for the plant to a greater extent than others, and will even leave fair feed to eat them.

Although the cause of death was fairly obvious, yet, owing to the previous history of the place, it was thought as well to submit smears and an ear to the Veterinary Pathologist (Dr. S. Dodd, D.V.Sc., M.R.C.V.S.), who reported that no pathogenic organisms were present. A few days later a second animal was found dead, and on post-mortem examination revealed a practically identical picture. Whilst the post-mortem on this animal was being carried out it was noticed that two more animals were down and in pain. They were immediately removed to the stables and drenched with Ol. lini, 1 pint, Ol. menth Pip, 1 drm., Spts. Ammon. arom, 1 oz. After backraking, copious enemata of cold water were administered with the garden hose, and as a result in one case a hard, elongated mass of vine, weighing 3½ lb., was passed, and almost immediate relief given to the animal.

In the other case relief had not occurred that night, so 1 oz. Chloral was given, and next morning a further half pint Ol. lini and copious enemata. As a result, two large masses similar to that removed from the previous case were passed. Both animals then made an uninterrupted recovery, and the remainder of the horses were removed from the paddock.

The cases are of interest not from the point of view of treatment, which merely follows routine lines, but because one particular article of food can be with certainty accused of being the direct cause of the impaction and mortality, and such knowledge is of considerable value to veterinarians called on to investigate mortality from unexplained causes in the back country of Australia.

Vineyard Notes for February.

The weather conditions experienced during the last month have been very favourable to the growth of fungi. Downy mildew has now made its appearance in most of the vine growing areas, and unfortunately in some parts has caused serious damage. Where spraying has been neglected in areas affected, the vineyards not sprayed have been severely hit. Where spraying has been resorted to in a thorough manner, the disease has been checked, and it behoves every grower in a season such as we have experienced to procure the necessary materials and proceed to apply Bordeaux mixture early. Growers should look upon the operation of spraying as an insurance, and should not wait until the disease makes its appearance to start work. Not only should individual growers consider the operation as in their own interests, but they should regard it as in the interests of and a duty to their neighbours. If all hands were to spray, the disease could be more easily kept in check with less expense to each grower. I have particularly noticed in parts where the disease is prevalent that vineyards not sprayed are proving breeding grounds—the prevailing winds carrying the spores and distributing them, thereby reinfecting the young growth on neighbouring vineyards.

Spraying should be attended to even after grapes have been vintaged if weather conditions appear at all likely to favour the development of the fungus. The healthier the foliage is kept, the better the wood for the following season.

Black spot has been bad in the irrigation areas, less marked in the metropolitan areas, and practically only noticeable in the Hunter River district. Oidium has shown up very little this season. Sulphuring has been carried out in many instances in the table-grape areas.

During this month cultivation should not be neglected, and after good rains the vineyards will benefit by the cultivator having been at work; it is surprising the difference in yield that neglect in this respect means. In the case of the young grafts also, the soil will need to be kept in good condition to produce as healthy and vigorous a vine as possible preparatory to Yema budding.—H. L. Manuel, Viticultural Expert.

Some Varieties of Oats.

It may be remarked that the Ruakura variety of oats is not fixed. We have a number of selections from it; one of these, Cowra No. 22, has taller and stronger straw than Ruakura, stooling somewhat less. Fulghum, a variety received from America, shows a number of late ripening plants and, like all other varieties, requires continuous selection.—J. T. Pridham, Plant Breeder.

Orchard and Garden Mites.

No. 2.—Spinning Mites (Family *Tetranychidæ*).

W. W. FROGGATT, F.L.S., Government Entomologist.

The mites belonging to the Family *Tetranychidæ* are known under the name of "red spiders," and are often very numerous in all stages of development upon the undersurface of the leaves of vegetables, field crops, or soft-foliaged garden plants. They spin a number of fine threads, under the protection of which they shelter; they feed upon the sap, and finally cause the foliage to turn yellow, wilt, and fall from the infested plant. The economic importance of these spinning mites can be understood from the fact that investigations carried out a few years ago by the officers of the United States Bureau of Entomology in the Southern States showed that the damage caused to the cotton crop by *Tetranychus bimaculatus* was estimated at over 2,000,000 dollars annually.

The typical genus *Tetranychus* was founded by Dufour in 1832 (*Annals Science Nature*, vol. xxv, p. 274). Banks defines the mites as follows: "The principal characters lie in the general shape of the body; clothed with bristles, with simple, moderate legs, with mandibles having the bases flattened and united into a retractile plate, with distal joints extremely long and slender, and with a palpus having the penultimate joint ending in a claw, while the last joint forms a 'thumb' bearing one or more fingers." In Rainbow's list (*Records of the Australian Museum*, vol. vi, p. 153), four species are recorded from Australia. Banks has described nine species from the United States, five of which were previously unknown.

In consideration of the structure of the claws and the specific characters of the genitalia, McGregor, in his paper "The Red Spider Mites of North America and a few European species likely to be Introduced" (1919), adopts the modern classification of these mites. Previously they had been grouped on the differences in the palpi and tarsi. Theobald, in his "Second Report on Economic Zoology" (issued by the British Museum in 1904), says that the English species so destructive on the hops is *Tetranychus athææ* and not the common red spider *T. telarius*, as previously recorded. *T. athææ* is also found on hollyhock and French beans. *T. cucumeris* is common on melons and cucumbers, *T. telarius* being the most serious pest on vines. Miss Ormerod gives a plate showing the life history of the last named species and a detailed description of the cosmopolitan mite (the typical red spider), with suggestions for keeping it in check.

An American species described by Banks under the name of *Tetranychus opuntiæ*, is common in Texas on the prickly pear, and is said to do a considerable amount of damage to this cactus: it might have some economic value in fighting our prickly pear pest in Australia. Another North

American species, *Tetranychus sexmaculatus*, infests the undersurface of the foliage of the orange and often causes a considerable amount of damage to the leaves. A semi-transparent mite of undetermined species did a great deal of damage to the sweet peas in suburban gardens near Sydney a few years ago, resting in blisters caused by their presence on the leaves. Infested plants wilted and died back without flowering.

Dusting the infested foliage with flowers of sulphur is one of the most effective measures for destroying mites; spraying with lime sulphur is also recommended, and tobacco and soap wash gives good results. These mixtures should be applied as soon as the first sign of mite infestation is noticed.

The Red Spider Mite (*Tetranychus telarius*, Linn.).

This type of the genus was originally described by Linnæus under the name of *Acarus telarius*, in 1761, but was placed in the present genus by Dufour in 1832. A cosmopolitan creature, world-wide in its range, and found upon many different food-plants, it has been described and redescribed under twenty-five different names. In the suburban gardens about Sydney, it is very common on many different plants. On a badly-infested leaf, mites in all stages of development and colour can be found running about or feeding. When the mites are numerous the whole of the infested leaves become discoloured with a sickly yellow tint, and the under surface is stained with spots of their excrement and covered with fine watery filaments, under which the mites shelter and develop.

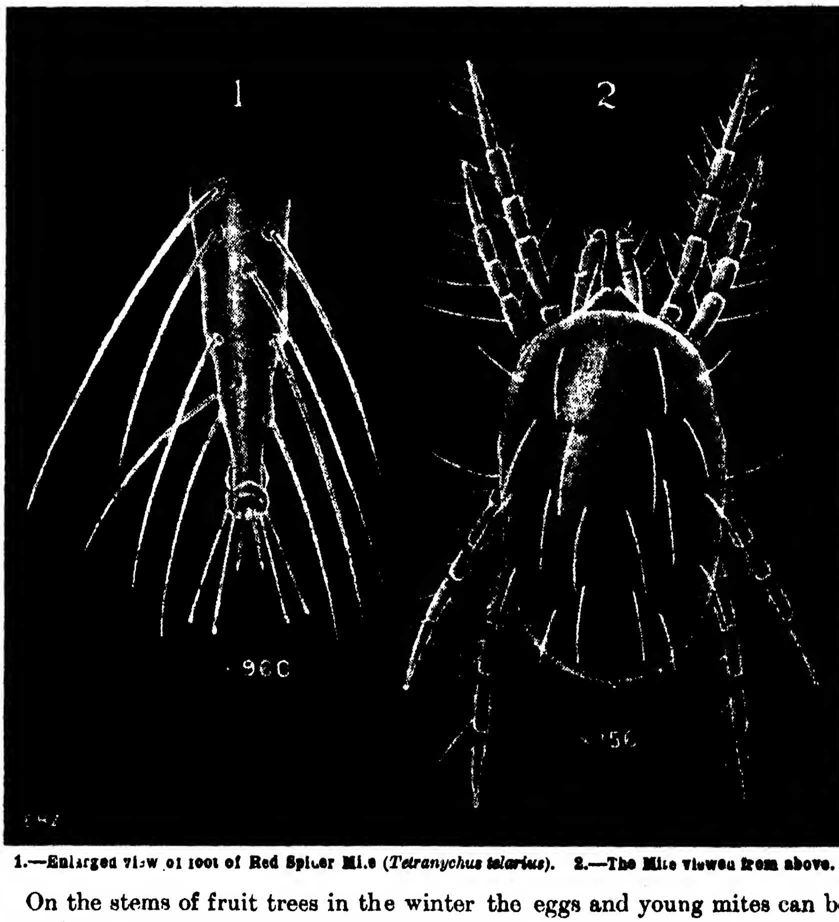
The males and females vary much in size. When first emerging from the egg case, they have only three pairs of legs, but they have developed a fourth pair by the time they have moulted and reached maturity.

The eggs, scattered over the underside of the leaf, are perfectly round and semi-transparent. The tiny larval mite on emergence is almost globular, semi-transparent, and has bright red eyes. In the next stage the mite becomes more oval, and of a pale greenish-yellow tint mottled on the back with dark spots. It subsequently takes on a reddish-yellow tint on the fore legs and head with large reddish eye spots, and the body becomes a dull yellow.

The adults (with the typical four pairs of legs) are of a dull brick-red, sometimes mottled with lighter yellow. The head, behind the head, and the legs are semi-transparent. The palpi folded together are rounded in front, and with the rest of the mouth parts project in front of the body; the legs are moderately long, of uniform thickness, clothed with long scattered white hairs, thickest and shortest on the tarsi. Viewed from above, the body is broadly oval, broadest behind the base of the second pair of legs, slightly constricted on either side, the apex rounded. The whole of the dorsal surface is clothed with long scattered white hairs forming four irregular parallel rows down the back.

The mites are very active, hiding under bits of dirt on the leaves and clustering along the midrib and cross veins. On account of their colour and small size they are very difficult to pick out on a discoloured or dirty leaf when

at rest. When disturbed they run quickly over a smooth surface. The specimens from which the descriptions were made were infesting the foliage of strawberries at Canley Vale. Some of the growers state that through their infestation a large percentage of their strawberry crop was destroyed this year. In consequence of the long dry spring, the roses in suburban gardens, particularly the small dwarf shrubby ones, suffered much this season (1920), from the attacks of red spider.



1.—Enlarged view of foot of Red Spider Mite (*Tetranychus telarius*). 2.—The Mite viewed from above.

On the stems of fruit trees in the winter the eggs and young mites can be destroyed with lime-sulphur, and as this mixture is greatly used as a winter spray by commercial orchardists, this mite does not cause them very much trouble. Dusting the infested foliage with flowers of sulphur is effective on rose bushes and other small garden plants.

The Apple Stem Mite (*Bryobia pratensis*, Garman).

These mites differ from the typical red spider mites in having the legs of irregular length, the first pair being nearly twice the length of the other legs. In earlier notices in economic literature they had been considered species of

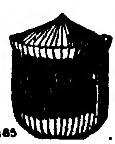
the genus *Tetranychus*, and it was not until 1885 that this species was carefully examined and described by Garman (in the Fourteenth Report of the State Entomologist of Illinois) under its present name, as a serious pest upon clover and blue grass.

In 1891 Messrs. Riley and Marlatt contributed to *Insect Life* (vol. iii, p. 45), a paper, illustrated with a fine plate, entitled "The Clover Mite"; but they recorded it upon many other plants, particularly apple, peach, and elm, in the departmental gardens at Washington. It now has a wide range over North America, and is a common pest in the orchards of California. It was recorded in New Zealand in *The New Zealand Farmer* in February, 1889. Professor F. M. Webster, who visited Australia in 1889, in his work entitled "Notes on some Injurious and Beneficial Insects in Australia and Tasmania," says: "What is known as the 'Bryobia Mite' (*Bryobia speciosa*?) is quite injurious to stone-fruit trees, and also to the apple tree. I saw it working on some of the trees on the Experiment Farm at Dookie, Victoria, and understand that it is very injurious elsewhere. Prof. J. L. Thompson, of the Agricultural College, is of opinion that the mite originates in the almond and spreads from there to the other fruit trees. They do not appear to injure the foliage, but cluster in great numbers on the young shoots, especially at the forks. Mr. Crawford also says that they give a pinkish-grey colour to the twigs, caused by the mixture of the white of the moulted skins, the red eggs, the pink of the young, and the dirty green of the mature mites, all huddled together."

Branch of Apple tree with eggs of Apple Stem Mite (*Bryobia pratensis*) covering the bark.

The area shown as white is actually a deep pink before the mites emerge.

A brief description of this mite is given in this *Gazette*, vol. ix, p. 686 (1898), and there is another note on it in answer to a correspondent in the same journal, vol. xxiv, p. 362 (1913). The specimens sent in for identification toward the end of winter are nearly always the massed eggs, covering patches of the bark on the trunks or branches of apple and plum trees. Portions of the wooden stakes near the trees, and even small stones or bits of wood on the ground, are often encrusted with these minute eggs. These dull-red eggs, which form a regular (reddish) covering over the bark as shown in the illustration, become white as the larval mites hatch out, the shells remaining attached to the bark for a considerable time after their emergence. When examined singly the eggs reveal a very interesting structure. They are hemispherical at the base (where they are attached to the bark), the rounded sides have a fine fluted surface, and the apex is covered with a conical lid, also fluted, and coming to a point in the centre, as seen in the illustration. Though their design is so distinctive compared with the ordinary smooth rounded eggs of other red spiders, I can find no description of these curious eggs in American reports. From specimens under observation the larval mites emerged from the eggs toward the end of September and early in October; they crawled about on the bark of the apple branches, and sheltered in the cracks and crevices. They are bright red, with an irregularly rounded form, the front portion sloping to the head, and the apical portion broadest; the dorsal surface covered with feather-shaped scales, which also form a regular fringe round the apical portion of the body. They are furnished with three pairs of legs, clothed with scattered hairs, with a very long hair at the tips of the tarsi of the front legs. These legs are much longer than the middle pair; the hind pair are longer than the middle, but not as long as the front legs. The tarsal claws curve outward, with distinct pulvilli between them.



Enlarged view of egg of *Bryobia pratensis*.

The adult mites have the characteristic four pairs of legs, the first pair much longer than the others. The mouth parts are produced in front of the cephalic portion, which is broadly-rounded in front, and from which the rest is truncate on the sides, with the apex rounded. The whole of the entire surface is finely striated and rugose, with feather-like scales upon the surface and margins. The long legs are also clothed with these curious elongate serrate scales. These mites vary much in colour from the larval stages to the perfect mite, which finally assumes a dull brick-red, sometimes dulled with bluish tints. When full grown, the mites may often be found massed together on the stem, trying to get over the codlin moth bandage.

Many parasites combine, with adverse weather conditions, to destroy fruit trees, and the amount of damage caused by these mites to those trees upon which they hibernate is still somewhat problematical. While the damage to grass, lucerne, clover, and other field crops in America is so very well defined, it is not so with orchard trees, and some writers have suggested that these

mites only use the trees for hibernation purposes and leave them later for field crops. We have no proof of this in Australia, but our evidence shows that after crawling up the stems of the apple trees they shelter in the bracts of the buds. One remarkable habit of these mites in the United States is that of swarming into houses for shelter in the winter, and becoming a domestic pest. We have no record of this in Australia.

Farmers' Experiment Plots.

Grasses and Clovers for the North Coast.

J. N. WHITTET, Assistant Agrostologist.

Plots were established on the property of Mr. C. Oliver, of Laureldale, Casino, for the purpose of ascertaining the value of certain grasses and clovers on the North coast, with a view to providing a change from paspalum. In addition to the plots already established and now described, Kikuyu grass and Shearman's clover have been planted recently.

Chloris gayana (Rhodes grass).—This plot is looking exceptionally well at present, being 2 feet high, and showing a mass of excellent succulent pasturage. Hay made from this plot last season was eaten readily by milking cows.

Pennisetum purpureum (Elephant grass).—This grass is one of the best reserve fodders for dry seasons. When fed (either chaffed or whole) to cows it was eaten eagerly. Best results are obtained from this grass by feeding off when 2 feet 6 inches to 3 feet high, the growth then being succulent and palatable.

Phalaris bulbosa (Toowoomba Canary grass).—Having been green right through the winter, and having provided a large quantity of fodder, this grass is now sending up seed stems, and occasional heads are carrying a large quantity of seed. As *Phalaris bulbosa* seed is at present unobtainable in New South Wales, and numerous inquiries are being received for it, it will be advisable for farmers who have plots of this grass to collect as much seed as possible this season. The grass still stands as one of the best of our winter grasses, and also makes a fair amount of growth in spring and summer.

Trifolium pratense perenne (Chilian clover).—Since this plot was established two years ago, numerous cuttings have been obtained from it. When harvested recently, carrying a six weeks' growth, the plot yielded 18 cwt. of hay per acre. It had attained to a height of 3 feet.

Melilotus alba (Bokhara clover).—This plot was planted in June, 1920, Algerian oats being used as a cover crop. The oats were harvested for hay, and the clover is now 18 inches high.

Installation of Ball Bearings on Combined Churns and Workers.

The manager of a large co-operative dairy company on the North Coast has installed self-aligning ball bearings on the churns in use at his factory in place of the plain bearings and rollers supplied by the makers. By this means he has effected a wonderful saving in the power required to drive the churns, has given the belts an indefinite life, has reduced the strain on the driving gear and clutches to a minimum, and has removed strains from the body of the churn. It is a comparatively easy matter now to move a loaded churn by hand.

Two single sets of heavy duty self-aligning ball races were used for the front bearings in place of the plain rollers, and a double set of the same kind to support the spindle at the rear of the churn. The cost, together with the fitting, came to about £20 per churn.

After a six months' trial with one churn the results were so very satisfactory that the other churns have been similarly fitted.

The engineer at the factory estimates that 90 per cent. of the power required to drive the churns with plain bearings is now saved as the result of the use of ball bearings. The life of the driving belts has been greatly lengthened, as they can now be used comparatively slack. With plain bearings the belts had to have an almost "fiddle-string" tightness to ensure a satisfactory drive. The churn revolved with a smoothness unknown in churns equipped with plain bearings.

One of the troubles of plain bearings is that as they wear they allow the front of the churn to drop somewhat, the resultant strain in the churn-body causing little cracks and other slight openings in the wood, which are difficult to keep clean inside the churn.

The bearings only require attention about every six weeks, when they should be well packed with vaseline as a lubricant.—O. C. Ballhausen, Dairy Instructor.

The Influence of an Assured Market.

The average well-trained farmer needs no great instruction in how to make his farm fruitful; he does require instruction in how to make his fruits profitable. And until he has this knowledge he will never be convinced that it is worth while to try to increase their yield. Thus I am firmly convinced that Mr. Midleton, in his painstaking monograph on the superior yield of German land over English, missed a large part of the whole secret when he failed to remark that the German farmer is sure of a market for everything he produces, while the English farmer is not. Having seen many thousand pounds' worth of potatoes rot in the ground in Ireland, I feel little surprise that the Irish farmer has no great enthusiasm to grow 20 tons to the acre instead of 10.—Lionel Smith-Gordon in *Better Business.*

Mould often appears on the top of jam if it is not immediately covered after being placed in the bottles; the spores of the fungus are floating in the air and if they lodge on cool jam will in due course develop. As a rule the only objection to the fungus is its appearance.—W. J. Allen.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture now publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of wheat, oats, maize, sorghum, Sudan grass, potatoes, and other crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

This list is compiled after inspection of the seed and report by a field officer of the Department (preferably during the growth of the crop), and farmers who have pure high-class seed of good quality of any variety of farm crop are therefore invited to communicate with the Under Secretary and Director, Department of Agriculture, Sydney.

The Department does not undertake to buy any of the seed, but recommends the grower by publishing his name in this list. The following list indicates where pure seed, recommended by the Department, is at present obtainable:—

Wheat :—

Billy Hughes	Manager, Experiment Farm, Condobolin.
Bomen	Manager, Experiment Farm, Temora.
Canberra...	Tayler, Lloyd and Co., Adavale, Parkes.
	H. K. Nock, Nelungaloo.
	R. J. O. Berryman, Aniemoore, Botfield's Siding.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
Clarendon	J. Parslow, Collie-road, Gilgandra.
	Manager, Experiment Farm, Condoblin.
Cleveland	J. Burns, Goongawarrie, Carcoar.
College Purple	Manager, Experiment Farm, Temora.
Comeback	Manager, Experiment Farm, Temora.
Cowra No. 15	H. K. Nock, Nelungaloo.
Cowra No. 19	H. K. Nock, Nelungaloo.
Currawa	J. Parslow, Collie-road, Gilgandra.
	Manager, Experiment Farm, Temora.
Federation	J. Parslow, Collie-road, Gilgandra.
	Manager, Experiment Farm, Temora.
Firbank	J. Parslow, Collie-road, Gilgandra.
	Manager, Experiment Farm, Nyngan.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
Florence...	J. Parslow, Collie-road, Gilgandra.
	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Condobolin.
Golden Return	H. K. Nock, Nelungaloo.
Gresley 83	Manager, Experiment Farm, Temora.
Hard Federation	H. K. Nock, Nelungaloo.
	J. Parslow, Collie-road, Gilgandra.
	H. E. Stanley, Longreach, Young.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Condobolin.
Improved Steinwedel	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
King's Red	Manager, Experiment Farm, Temora.
King's White	Manager, Experiment Farm, Temora.
Marshall's No. 3	Manager, Experiment Farm, Temora.
Major	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Temora.
Onas	H. K. Nock, Nelungaloo.
Penny	W. A. Graham, Rippingham Grange, Barellan.
	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Temora.
Red Wing	Manager, Experiment Farm, Condobolin.

PURE SEED—*continued.*

Wheat—continued.

Roseworthy	H. K. Nock, Nelungaloo.
Rymer	W. A. Graham, Rippingham Grange, Barellan.
	Tayler, Lloyd and Co., Adavale, Parkes.
Steinwedel	Tayler, Lloyd and Co., Adavale, Parkes.
Thew	Manager, Experiment Farm, Glen Innes.
Turvey	H. K. Nock, Nelungaloo.
	W. W. Watson, "Woodbine," Tichborne.
Viking	Tayler, Lloyd and Co., Adavale, Parkes.
Warren	Manager, Experiment Farm, Trangie.
Warden	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Temora.
Yandilla King	W. L. Forsyth, Braeside, Wallendbeen.
	Manager, Experiment Farm, Temora.
Zealand	Manager, Experiment Farm, Temora.
Zealand Blue	H. K. Nock, Nelungaloo.

Oats :—

Guyra	H. K. Nock, Nelungaloo.
	A. J. Bassett, Nyrang Creek, *via* Canowindra.
Sunrise	H. K. Nock, Nelungaloo.

Grasses :—

Paspalum	Manager, Experiment Farm, Lismore.
Sudan Grass	W. W. Hosking, Farm 778, Leeton.
	Department of Agriculture, Sydney.
Elephant Grass (roots and cuttings)	Principal, Hawkesbury A. College, Richmond.
	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Yanco.
Kikuyu Grass (roots)	Principal, Hawkesbury A. College, Richmond.

Clovers :—

Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
Bokhara Clover or Sweet Clover	A. Sommerlad, Hillcrest, Tenterfield.

It is especially desired at the present time to locate reliable sources of seed of Thew, Huguenot, Firbank, and Florence wheats, Sunrise, Ruakura, and Guyra oats, and Cape and Skinless barleys, the demand for seed of which for coastal green fodder far exceeds the visible supply.

PRESERVING CUCUMBERS.

IN preserving cucumbers select the vegetable when firm, slightly turning to yellow, but avoid ripe specimens.

Peel and cut in slices or squares; place the pieces in salt and water for about eight hours or longer, using about 1 lb. salt to 5 gallons of water. Remove cucumber from the brine and allow it to drain; meantime add malt vinegar to the brine at the rate of 1 tablespoonful per pint of brine. Place cucumber in the jars, packing firmly and filling to within ½ inch of the top. Now add the salt-vinegar solution, filling the jars to overflowing. Put on rubbers, fix caps, place the jars in warm water and bring them to the boil. Boil for 30 minutes, remove jars and cool; see that the lids are screwed down tightly. If cans are used, only fill to within half-inch of the top with vinegar, as if the liquid touches the top of the can the cap cannot be soldered on.—W. J. ALLEN.

Poultry Notes.

FEBRUARY.

JAMES HADLINGTON, Poultry Expert.

THE continuous and sometimes heavy rains that fell during the latter part of December and early part of last month were responsible for some inconvenience as well as loss of egg-yield for a time. This has been a matter of common complaint among poultry-farmers, but these summer rains will prove beneficial in more ways than one. First, they insure green feed for the birds, and second, they should have a very appreciable effect on the food supply. Dry conditions mean a big demand upon mill offal, and, in fact, on almost all classes of poultry food for the purpose of feeding larger stock. The dairyman, for instance, in dry seasons is a big competitor for our foodstuffs. It follows that when there is good pasture and crops, other things being equal, poultry foods should cheapen; added to this, these summer rains should insure good crops of maize. Taken altogether, what with a bountiful harvest and the prospects outlined above, the tension on the poultry food position that has been felt for many months should be much relieved. As mentioned in last month's notes, the prospects for 1921 appear to be particularly favourable, and we have every reason to be optimistic in so far as the commercial aspect is concerned.

Autumn Expectations.

Many birds will now be falling into moult and the egg-yield from hens will be on the down grade during the next three or four months. The novice poultry-farmer is sometimes discouraged by this falling-off, and is prone to attribute it to causes other than the right ones, which are seasonal factors over which he has no control, except that the better the birds are looked after the better will be the egg-yield. Hens that do not moult at the present time but continue to lay, should be leg-banded as a means of distinguishing them from the remainder of the flock, so that a selection can be made from them for breeding purposes, provided always, of course, that they moult early enough to come in for that purpose. These are the really valuable hens of high laying capacity.

A distinction should be made between hens that lay well through the autumn to about April and then go into moult, and those that continue to lay and do not moult until the winter is upon them. The former will have put on their new coat and be fit for breeding from about midwinter, while the latter will not have moulted early enough to be ready for the breeding-pen. Besides, these hens that have laid right into the winter, although very desirable hens from a laying point of view, are mostly so exhausted as to be almost useless as breeders the following spring; there are of course

exceptions, but the usual result is a poor class of egg, infertility, low hatchability, and worse rearing results with the chickens. There is, therefore, a limitation to the usefulness of late moulters in this regard.

Old Hens Must Go.

No time should now be lost in disposing of hens that have finished their second laying season. It is somewhat surprising in these times of high cost of feeding to find large numbers of hens that have finished their profitable laying period still kept on the farm in the hope that they will again become profitable. As an instance of this it is not an uncommon occurrence to find a farm composed of 50 per cent. third-year hens, only 30 per cent. second-year hens, and 20 per cent. first-year birds, with 50 per cent. pullets in sight to replace them. In the first place, the 50 per cent. and 30 per cent., total 80 per cent., of such a flock should be disposed of during the summer, with exception of a small number of hens that continue to lay. To put such a farm on a profitable basis would necessitate the disposal of the unprofitable 80 per cent. of old hens, leaving the 20 per cent. of young hens and 50 per cent. of pullets coming on—a total of 70 per cent. of the original number as effectives. Such a farm would have slipped back by 30 per cent. of its total effective layers. Unfortunately this is no imaginative picture; it represents the approximate position of farms that can be counted by the score. Such farms, too, change hands as a result of failure, and the number of men who make failures is thereby multiplied. It is according to these failures that poultry farming is too often judged.

Healthy signs on any poultry farm at this time of the year are:—

1. That practically no three-year hens have been kept, and only half or less of the stock is comprised of hens in their second year of laying. All hens of this age should have been marked with leg bands the previous year.
2. That the balance of the stock are first-year hens, with a number of early pullets coming along—sufficient to insure that at least half the entire laying stock on the farm will be replaced by them. Unless a farm is in this position it is on the down grade.

Avian Diphtheria—or Roup.

The character of the summer so far experienced would lead to the expectation that roup is likely to be more than ordinarily prevalent during the autumn, and in fact from this month onwards. Roup is one of the most common diseases of poultry and turkeys, and very few farms, if indeed any, can claim entire immunity from it at some time. It is often alleged that roup has been introduced into a flock by some particular bird or birds brought in, or that the infection has, in some way or other, been carried from a neighbouring flock, but experience is all against such an explanation of the presence of roup on a farm as a general thing. The facts are that it is found difficult artificially to transmit this disease from one bird to another, and unless the conditions on a farm are favourable to its development there need be little fear in this regard. Nor is evidence in any

way conclusive that susceptibility to roup is inherited except in so far as constitutional weakness might be a factor in susceptibility. Nor is any age or condition altogether immune from this disease, though mature birds are much less susceptible to it than young stock. The high susceptibility of late hatched, weedy, or badly reared chickens is well known.

Predisposing Influences.

The conditions under which birds are housed and run appear to be much greater factors in bringing about an epidemic of roup than either direct infection, susceptibility, or the factor of inheritance.

The predisposing or favourable conditions to an epidemic of roup might be summarised as follows:—

1. Grouping too many stock into one house or enclosure.
2. Ill-ventilated poultry-houses, including even open fronted houses that are either too low from floor to roof, or that have no aperture at the back under the roof through which a current of air may pass carrying off the exhalations of the birds while at roost.
3. Roosts placed too close together, which means congestion, however large the house may be.
4. Ill-conditioned stock from any cause whatever.
5. Spraying the walls of poultry houses late in the evening and thus creating a steaming atmosphere in which the birds must roost during the night.

Three Classes of Roup.

There are three well defined diseased conditions known among poultrymen as roup. These may be described and treated as in the following paragraphs:—

First.—The principal symptoms in the first form is an offensive catarrhal discharge from the nostrils, which later, if the disease becomes progressive, will be sealed. An accumulation of pus takes place among the tissues of the head, and mostly finds expression through one or both eyes, which often become bulged. Medicines given internally are of little service, although in the early stages some cases appear to benefit by the administration of one-grain doses of quinine twice daily in a bolus of pollard, or some such vehicle.

Being a localised disease, probably the best methods of treating this form of roup is, first to syringe out the nostrils and corners of the eyes (if necessary twice daily) with equal quantities of peroxide of hydrogen and water. The following may also be used with some measure of success:—Kerosene (undiluted) or a strong solution of permanganate of potash; boracic acid and salt solution, made by dissolving a teaspoonful of boracic acid and half a teaspoonful of common salt in half a pint of boiling water, and allowed to cool before using. If no other syringe is handy, a common sewing machine oil-can may be used. In bad cases, where the eyes are bulged with the disease, it is better to kill the bird at once.

A good way to force the bird to clear the head and nostrils of the mucus is to submerge the head up to the eyes in a solution of permanganate of

potash made about the colour of claret. The immersion should take place for a few seconds, the bird's head being held in such a position that it cannot breathe without taking in the solution; this will cause it to eject much of the objectionable mucus. If this is done previous to the syringing, the latter will be much more effective.

Second.—A kind of roup which attacks both young and adult is very similar to the diphtheria that affects children. This will be recognised by the false spotted membrane in the throat and mouth of the bird. With this kind the health of the bird is affected sometimes to extreme prostration, and many die in the space of a few days. This form is apparently much more contagious than the other, and there are practically no outward symptoms as in the previous kind. Flowers of sulphur lightly dusted into the throat twice daily is almost a specific cure for this form of avian diphtheria, if taken in time.

Third.—This is known among poultrymen as canker; it is a less prevalent and, perhaps, less contagious form than the others, but it attacks young and old alike. It has a less debilitating effect upon the birds—in fact, they may have this disease and still appear in the best of health. The symptoms of canker are a gasping or choking sensation, and the bird will sometimes cry out in its endeavour to get its breath. Upon examination it will be found there is a cheesy-looking substance growing round the windpipe, and sometimes in the mouth, on the side of the throat, or even on the tongue.

The remedy is to remove this substance with a piece of wire bent in the form of a small loop, taking care that the affected part is not made to bleed; also, when round the windpipe, that no particle is allowed to fall into that aperture or the result will be fatal. After the removal of the substance, the affected part may be painted with a saturated solution of permanganate of potash or glycerine and iodine in the proportion of one part iodine to ten of glycerine. Another, but rather drastic, remedy is to apply very finely powdered bluestone and permanganate of potash in equal quantities, well mixed. In each case the remedy should be applied twice daily.

The poultry-keeper should be on the look-out for small patches of this cheesy-looking substance as described, as they are often the first indication of the presence of canker among the flock. Poultry-keepers should not delude themselves with the idea that dosing their birds with chemicals and disinfecting poultry houses will keep roup away. Good conditions are the main protection.

FALL ploughing is the most universally effective way of controlling the insect pests that annually cause great losses to the grain farmer. It is much easier and cheaper, says the Bureau of Etomology, United States Department of Agriculture, to prevent an insect outbreak in this manner, than it is to stamp out the infestation once it is fully developed . . . . Fall ploughing is recommended because it breaks up the soil and destroys the bugs and pupæ of many insects by exposing them to the sun and air.—*Weekly News Letter.*

Orchard Notes.

FEBRUARY.

W. J. ALLEN and S. A. HOGG.

GENERALLY speaking the latter end of this month is a very busy one amongst sultana, raisin, and prune growers. As pointed out in previous notes, sultanas should be allowed to become perfectly ripe before being picked and dipped; in fact the old plan adopted in the Irrigation Areas is that after it is considered the sultanas are fit to pick they are given another fortnight, in order to make sure that they may be so. With regard to currants, the time for picking is guaged to a certain extent by their appearance. If, upon testing, the berries are found to be sweet they should be allowed to hang still longer until they have attained their maximum amount of sugar. A small proportion of the small berries may shrivel, but these smaller berries may be removed in grading, while the other larger berries will add very materially to the ultimate weight as a result of the extra amount of sugar developed.

By the end of this month, or perhaps earlier, some of the prunes will have ripened and fallen. It has been found that the early maturing prunes as a rule do not possess sufficient su gar to ensure their keeping qualities. This being so, in processing they should also be kept apart from the main crop, care being taken not to mix them, and they should be disposed of as early as possible.

It is not meant that the early prunes will not keep, but as they lack sugar, which is their natural preservative, they are apt to go mouldy if stored under humid conditions such as exist at sea level.

Prunes which have fallen on to rough ground may become split and get full of grit. It is advisable when picking up prunes to use two boxes, the whole fruit to be put in one, and the bruised in the other. The split fruit should be thoroughly washed in cold water before being dipped in the boiling caustic solution. There is a tendency amongst prune growers who are anxious to place their dried products on the market, to pick their fruit on the early side; this should be avoided, as the product will not then be particularly attractive, and may go mouldy through not containing its maximum amount of sugar. It is desired to emphasise this, as the best article can only be produced from prunes that have thoroughly ripened before being processed. If, on the other hand, as the result of heavy winds, prunes should be blown from the trees, as frequently occurs, they may be gathered, placed on wooden trays, and allowed to ripen, after which the dirty ones should be washed prior to dipping. With regard to the Robe de Sergeant variety, it has been found that fruit that was practically green, *i.e.*, only slightly coloured on one side, will mature well on trays, and may be converted into a good saleable article. Prunes should not be taken from the trays until thoroughly cured, as insufficient curing is often the cause of their going mouldy later

Harvesting.

Fruit harvested for market purposes should be picked while cool. This cannot be emphasised too frequently, as a lot of the fruit which is placed on the Sydney markets arrives in very bad condition as a result of being picked while warm. Such fruits as apples and pears should be graded and packed, and the larger grades wrapped. In packing grapes, at least 24 lb. should be placed in each box. Only use grape cases when packing this fruit for market.

It will be found of assistance to retail purchasers of grapes if they should be able to remove the bunches without breaking the berries. This can to some extent be provided for by leaving the stalks of a few of the bunches exposed on the top layer, so that these bunches may be lifted out first.

Scale Insects.

The various scale insects, including white louse, should be treated either by fumigation or by spraying with special resin and soda wash ; leaflets giving the formula to be used may be had free on application to the Under Secretary and Director, Department of Agriculture, Sydney.

Fumigation should only be carried out during the time of the day when the temperature is fairly cool. It is advisable also to select a cloudy day. Do not spray if the weather be very hot; a cloudy day is better for spraying as well as for fumigating.

Citrus trees sprayed with lime-sulphur solution for black spot and other fungus diseases will be benefited at this season. This spray is an insecticide as well as a fungicide.

Examine all apple and pear trees for the presence of codlin moth, and remove and destroy any affected fruit; spray with arsenate of lead if necessary.

All fruit affected with fruit fly should be picked up and destroyed by either burning or boiling. Baits, such as kerosene placed in shallow tins, will be found beneficial in reducing the pest.

The Value of Soiling Crops.

Peas, beans and vetches are neglected crops to-day, although they figured prominently in British agriculture before the era of the turnip. They enrich the soil and perform the work of the harrow and the cultivator. When mixed with cereals they make a growth so dense as to destroy practically all weeds, and so make hoeing unnecessary.

We may perhaps hope that, just as in the eighteenth century the cultivation of the turnip increased the productiveness of the agriculture of this country, so may the general adoption of soiling crops on our farms mark the commencement of a new period of prosperity in the era which lies before us. —Jas C. Brown in *The Journal of the Ministry of Agriculture*, England.

Agricultural Bureau of New South Wales.

SUGGESTED SUBJECTS FOR BUREAU MEETINGS.

It sometimes happens that, owing to some inadvertence, members of branches meet without having any particular subject before them. In such a case one of the following paragraphs may provoke a useful discussion, and a brief report of the discussion will often interest other branches.

Do you grade your seed wheat or oats to get rid of weed seeds and small, light grains? The weeds are obviously objectionable, and the small grains tend to produce poor, unprofitable crops; what has been your experience with clean, well-graded samples of seed, compared with ungraded?

What difference have you observed between the germination of hard, sound grain and grain that has been saved from a crop that was exposed to much rain about harvest time? What quantity of these classes of seed would you allow per acre?

Is it your practice during summer to work the fallow after each rain? Do you consider it has any other influence than conserving the moisture? Does the interference with carting grain make it unprofitable in your district?

What crops have you been in the habit of raising in the orchard for green manuring purposes? Do you find legumes (such as field peas and vetches) any better than rye, barley, and the like? What have you found is the best time to sow the different classes of crop? Do you use fertilisers, and if so, of what kind, and in what quantity per acre?

What are the best crops to sow for winter and spring feed in your district? What preparation do you give the soil, and what quantity of seed do you use per acre? Have you tried superphosphate, and with what results?

Do farmers, when visiting agricultural shows, take full advantage of the opportunities such fixtures afford? In what particular direction could greater benefit be derived?

DISTRICT CONFERENCE AT ORANGE.

At the suggestion of the Borenore branch of the Agricultural Bureau, a conference of delegates from the branches of the Bureau in the Orange district has been convened for 10th February at Orange. This conference is the first of its kind to be held in New South Wales, and is therefore an extremely interesting mark of progress in the Bureau movement. It is believed that it will be the first of many district conferences, and the results of its deliberations should prove interesting to branches of the Bureau throughout the State.

The subjects for discussion, suggested by several branches in the district, afford a comprehensive programme and should result in decisions that will be of interest to all members of the Bureau.

REPORTS AND NOTICES FROM BRANCHES.

NOTE.—While gladly publishing in these columns the views of members of the various Branches of the Agricultural Bureau, the Department does not necessarily endorse the opinions expressed.

Auburn.

The monthly meeting was held on 11th December, when formal business was transacted. Two members produced exhibits that were duly admired and criticised, both being of excellent quality.

Bimbaya.

At a meeting on 27th November, a paper was read by Mr. E. T. Boller, manager of the Candelo butter factory, on the care and preservation of cream.

Mr. Boller dealt with the subject under three headings, viz., milking, separating, and caring for cream. The first he regarded as having a most important bearing on the whole matter. Whether milking was done by hand or machine would not affect the flavour of the milk; it was only affected by neglect or ignorance on the part of the operator. Unclean milking was fatal to the production of a fine flavoured butter. It might be said that the milking machine overcame the possibility of manure dropping into the pail, but the teat cups enveloped the teats, and rendered preliminary cleaning quite as necessary as in hand milking.

The practice of leaving the separator unwashed for two or three separatings was surely the last word in uncleanliness. Clean brushes and clean water were essential for cleansing purposes. Water that had been used for washing the dairy utensils and stored for future use, should on no account be used for the separator, even though it had been boiled.

The butter-fat content should be maintained at 40 per cent. in the six summer months, in order that undue sourness should be avoided in cream two days old. Over-ripe cream ordinarily produced a flat-flavoured, first-grade butter. It was a difficulty that always confronted the butter-maker in warm weather, for the cream might be produced under reasonably clean conditions, but no attempt be made to control the development of acidity while waiting delivery. This was largely a question of temperature; the fact that cream produced in winter was quite sweet at two days old was ample evidence. If cool water was available, the cream vessels should be stood in water till the contents were cooled to the temperature of the water, but no longer. Wet sacks would then provide a remarkably effective cooling medium, and that treatment should be continued till the cream arrived at the factory. Another important factor in the care of cream was that the surroundings should be clean, and the atmosphere in which it is kept sweet and free from any evil smells. After twenty years' association with the business of butter-production, he had hit upon no more effective method of cleaning dairy utensils, structures and floors, than clean, hot soda-water, a good brush or broom, and a liberal use of "elbow grease." The practice of smothering unclean and "smellful" places in and around the cream-room with lime or disinfectant, he strongly condemned, for such substances only added to the number of smells. An ounce of ordinary cleanliness was worth a ton of nauseous disinfectant.

A meeting was held on 18th December, when arrangements were made for expected visits of Departmental experts. A committee was appointed to arrange for an exhibit at the Candelo show.

The annual picnic of the branch will be held in March, when a junior cattle-judging competition will be a feature of the programme.

A rain gauge is being purchased for the use of the branch.

At a meeting on 18th December a motion was carried asking the Government to acquire an area of land in the Candelo district for the purpose of establishing an experiment farm.

The Department at a later date replied that it had no funds for the purpose, but every endeavour would be made to carry out experiments by means of farmers' experiment plots during the coming season.

Borenore.

A well attended meeting was held on 17th November, when Mr. R. C. Bell, M.R.C.V.S., delivered a lecture on some diseases of animals.

The symptoms by which common ailments could be detected were described, and the most convenient remedies mentioned. A feature of the lecture was a description of the appearance of an animal in health. The horse always stood with his fore feet square on the ground; he never rested a fore foot unless lame; a hind foot might be rested on a toe. The head should always be alert, eyes wide open, ears pricking to and fro. The coat should be shiny and supple. Cows, in health, should be chewing the cud, and should have a moist muzzle. A dry muzzle was one of the surest indications that there was something wrong. The skin should be supple, and the hair licked up in places.

A number of pasture grasses are being grown by members, and are under observation to determine their suitability for local purposes.

At a meeting on 11th December it was decided to conduct crop-growing competitions among members next season. The conditions provide for two competitions, one for oaten hay, and the other for wheaten hay, area not to be less than four acres, and must commence at one boundary of the crop, allowing half-a-chain for a headland which will not be included in the area; competitors to keep a correct record of the working of the land, implements used, depth of ploughing, amount of seed sown, and amount and nature of manures used.

Castle Hill.

A meeting was held on 14th December, when general business was dealt with. It was agreed to enter a competitive exhibit at the show, to be held locally, in February.

Clifton (near Young).

The November meeting of this branch was well attended. The business was a paper by Mr. H. Whiteside on superphosphate and its manufacture and use. This proved interesting and instructive, and led Mr. Whiteside, at the conclusion, to point out the advantages of fallowing as maintaining the moisture content of the soil, thus providing the means for mineral plant foods in the soil being dissolved and made available to plants.

Cordeaux-Goondarin.

At the monthly meeting on 25th November a paper was read by Mr. Cowain on his experiences in spraying. It was one of the three essentials to success in orcharding, he said, the others being cultivation and pruning. Unless spraying was done at the right time, the benefits of the other two operations were lost. He was well satisfied with red oils for winter and early spring spraying for aphis and scale, and as a fungicide he had absolute faith in lime-sulphur. The most important times for its use, he considered, were (1) when the cluster buds open, and (2) at the petal-fall stage. Arsenate of lead and tobacco wash could be added, if necessary, with the last application. Bordeaux mixture he considered equal to, if not superior, to lime-sulphur, but freshly-burnt lime should be used, and it was not always available.

An interesting summary of fodder crops grown in the district was also presented to the meeting, and provoked a useful discussion.

Garra-Pinecliff.

A demonstration of summer thinning was given by Mr. W. le G. Brereton, Assistant Fruit Expert, on 1st December. Several orchards were visited, a number of members following Mr. Brereton round and deriving a good deal of valuable information from him. The object of the operation, it was

pointed out, was to thin out any strong growth and to cut back some of the leaders to help balance the growth of the tree. In other cases, the shortening back of the laterals produced fruit buds the sooner.

Gerringong.

On 4th December Mr. E. Breakwell visited this district and lectured on the subject of grasses, using at the same time lantern slides to illustrate his remarks. The following is a summary of the lecture :—

Grasses and Fodder Plants for the Kiama District.

The soil and climate of the district was particularly adapted for introduced grasses. This was well seen in the manner in which paspalum had spread throughout the alluvial and volcanic soils of the district. It was formerly thought that this grass would not thrive sufficiently to be remunerative on the South Coast, but it was now extremely doubtful if it did not grow just as vigorously here as on the northern rivers. Paspalum had a wonderful carrying capacity, given a good amount of heat and moisture. At the same time no dairy herd would maintain really good condition and full milk supply on this grass alone, and it was also a very bad pest if allowed to spread on to crop land. Under no condition should a farmer rely on paspalum alone. It would pay him to have paddocks of other grasses, even if they did not have the same carrying capacity as the paspalum.

There were plenty of such grasses to choose from. The well known mixture of perennial rye, cocksfoot, prairie, and red clover still took a bit of beating on the South Coast. If these grasses and clovers became properly established, and were treated judiciously they would last some time, and provide first-class feed, particularly if the clover maintained its growth.

A grass that was making great headway in popularity was *Phalaris bulbosa*. This was a splendid winter grass, and if allowed to become well established it would provide good permanent pasture for a considerable period. It grew well with Bokhara or sweet clover, and a combination of these two could be highly recommended.

Other promising summer grasses which were yet little known were Kikuyu grass and elephant grass. The latter should not be allowed to become too coarse, and appeared to give more succulent feed if grazed closely when it was once established.

Sudan grass needed little emphasis. It was already well known as one of the most palatable and drought-resistant grasses.

Shearman's clover was recommended for moist situations ; it was particularly valuable during the summer months.

Saccaline sorghum was mentioned as useful on the South Coast, being a very vigorous strain, fairly free from disease, and capable of standing a deal of cutting. It provided feed well into the winter.

The Department would be pleased to co-operate with farmers who wished to try grasses for their own conditions.

Glenfield.

General business was transacted at a meeting of this branch, held on 14th December.

Glenorie.

At a meeting on 27th November, a discussion took place on the heavy falling of young citrus fruit in the district, which was generally believed to be due to a dry spring (locally) being followed by a few steady showers.

On 18th December the subject of workmen's compensation was the text of a paper read by Mr. W. P. Scott, and of a short discussion.

Kellyville.

A lecture was given by Mr. Froggatt, on insect pests, on 3rd December, and was much appreciated by all hearers.

At a meeting on 4th December a paper was read by Mr. H. Reid, of which a summary follows :—

Soursap or Sunscald.

The worst trouble the apple grower in that district had to contend with was soursap or sunscald. This made its appearance early in the spring when the sap was coming up from the roots. Variations in temperature, he thought, were the cause of the trouble.

One day hot and the next morning nearly a frost were the days that seemed to him to be responsible for all the trouble. The trees appeared to be all right till the sap was on the move, and then the trouble came in a few days. To the experienced eye it was noticeable as soon as the leaf eye began to open. The first appearance of green tinge told the tale. The edge of the leaf showed a scorched and black appearance, the bud or eye failing to open out to leaf, the bark showing a yellowish, blistery, or burnt appearance, with little wart-like lumps. In very bad cases the part might show a smoky or sooty ring round the limb or barrel. In a very short time the bark could be broken with the fingers. At other times, the sap in such trees was sticky to the touch and smelled sour, as though it were fermenting. Sometimes only one limb was affected, and in other cases the tree was affected all over. It was not, in his opinion, caused by root trouble, because in most trees if the top died the butt nearly always threw out shoots again. His experience was that soursap was more prevalent in trees until they began to bear regular crops. Though he had seen trees scorched very badly when in full bearing, the first six or seven years was usually the worst.

Was there any preventive for it? Mr. Reid could not say that he knew of any cure other than that he had always used, viz., lime-sulphur applied just before the eyes opened. The trees should be drenched all over, and the bark kept clean and free from all fungus and other diseases, and from all lichens and beardy moss. From information gathered from growers, he had found the worst results were obtained by those who did not use lime-sulphur. This year he only had three two-year-old trees affected with soursap and only one of them died to the ground; they had been brushed over with red oil emulsion and were not treated with lime-sulphur. Mr. Reid did not recommend cutting back or pruning out the affected parts until the following winter. This gave time to see how far down the tree the effect of the scald would go. Sometimes the tree was only scalded down a short distance, but generally to the thicker bark, where good long shoots would be made by the next winter. If there was not good vigorous young wood to start the tree with again by the next pruning season, he would advise pulling out and replanting. He would very much like to know what was the experience of apple and pear growers with a regular system of spraying over a period of, say, ten years or more with lime-sulphur or bluestone sprays.

Mount Keira.

There was a good gathering of members at a demonstration of summer thinning conducted by Mr. G. A. Jones, Fruit Inspector, on 14th December. A number of trees were handled to the advantage of all present. In the evening Mr. Jones gave a lecture on the planting out of an orchard, the planting of trees, and their pruning until they were full grown. The best varieties for the district, the principal pests and diseases, and the correct control for each were all dealt with, and the vote of thanks at the close was a cordial one.

This branch was only formed in March, a few members taking the matter up enthusiastically, but many other producers being rather suspicious of the venture. The year has been one of useful activity, and most of the doubts have been swept aside. The opinion of most of the members is that the coming year will be a really successful one.

Penrose-Kareela.

The annual meeting was held on 6th December, when the following officers were elected:—Chairman, Mr. H. Sendt; Vice-chairman, Mr. C. P. James; Treasurer, Mr. V. T. James; Hon. Secretary, Mr. C. Aye. The balance-sheet showed a credit balance of £9 2s. 4d., the amount including £5 4s. 3d., the net proceeds of the annual picnic.

Springside.

This branch conducted a crop-growing competition in the past season, and members found it a most interesting and profitable fixture. The judge's report, with some of his comments, appear on page 86 of this issue.

Thyra-Bunaloo.

The annual meeting was held on 20th November, when the following office-bearers were elected:—Chairman, Mr. W. Glenn; Vice-chairman, Mr. T. White; Treasurer, Mr. T. Tomlinson; Hon. Secretary, Mr. W. A. Glenn.

An interesting paper on wool-classing was read by Mr. C. Sinclair.

Toronto.

The annual meeting of this branch took place on 4th January. The report showed a membership of sixty, and a year of satisfactory activity, though the drought had had some effect upon operations as compared with the previous year. Useful papers had been read by several members, and two officers of the Department of Agriculture had visited the district. The balance-sheet showed a credit of £16 3s. 9d.

The election of officers resulted as follows:—Chairman, Mr. E. J. Stuart; Vice-chairman, Mr. J. Cockburn; Treasurer, Mr. L. Owen; Librarian, Mr. J. Payne; Auditors, Messrs. Martin and Walker; Hon. Secretary, Mr. J. Froome.

At an ordinary meeting on the same date arrangements were advanced for the branch's annual show on 29th January, in anticipation of which a generous schedule of prizes was prepared.

Wallsend.

Several meetings have been held recently with a view to the formation of a branch of the Agricultural Bureau at Wallsend, and after encountering some difficulties, success has now been attained.

The difficulty encountered in most districts is that of obtaining a suitable hall for meetings, in a conveniently-situated position. This has been one of the drawbacks to the establishment of a branch at Wallsend, and the proposal to erect a hall is receiving strong support. If a grant of land cannot be obtained from the Wallsend Coal Company, an allotment will be purchased and a hall erected thereon by voluntary labour. The cost of material is to be borne by the issue of 5s. shares in sufficient numbers to cover the cost, and to be redeemed by a levy of 1s. per month per member, and by letting the proposed hall for social and other purposes.

In the meantime meetings are to be held in members' private residences.

There is every indication that the keenness of the members of this new branch will bear good fruit in the coming year.

Warrah Creek.

A meeting was held on 21st December when Mr. D. Martin presided. Mr. H. J. Power, hon. secretary, reports that the branch is showing an active interest in local questions, including the clearing of local reserves of Bathurst burr, the improvement of the local recreation ground, and the placing of the machine gun allotted by the State War Trophies Committee.

The branch is also taking an interest in the noxious weeds of the district, and has asked for assistance in identifying them. The Government Botanist advised members to press and dry specimens of the weeds of the district and to send them to the Botanic Gardens, Sydney, for the names to be attached and information afforded.

Wellington.

A meeting was held on 30th November when Mr. S. A. Hogg, Assistant Fruit Expert, gave an interesting lecture on fruit-growing under irrigation in New South Wales. The nature of the work at Burrinjuck, and of the settlements on the Murrumbidgee Irrigation Area were indicated, and then

the lecturer proceeded to describe the methods adopted, the varieties used, and the prospects. The information was so given as to also afford valuable suggestions for fruit-growers in the Wellington district, more especially those who had command of water for irrigation.

Yarramalong.

A meeting was held on 22nd December, when general business was transacted. The subject of competing at the Newcastle show was mentioned and it was agreed to obtain information.

LIST OF BRANCHES.

Branch.	Hon. Sec.
Albury	T. Heathwood, P.O., Lavington, via Albury.
Auburn	J. J. Pratt, Karaba-rd., Auburn.
Baan Baa... ...	P. Gilbert, Baan Baa.
Balldale	H. Elrington, Balldale.
Bankstown ...	————
Bimbaya	J. R. Boller, Tantawanglo.
Blacktown ...	R. H. Lalor, P.O., Seven Hills.
Bobin	Chas. Pfeiffer, P.O., Marlee, via Wingham
Borambil	H. A. D. Crossman, "Homewood," Quirindi.
Borenore	G. Henderson, "Strathdoon," Borenore.
Braidwood ...	A. Page, Braidwood.
Campbelltown ...	Jas. Nicholls, Soldiers' Settlement, Campbelltown.
Cardiff	A. Barratt, Cardiff.
Castlereagh (Penrith.)	D. Hattersley, Penrith.
Cattai	A. J. McDonald, Cattai, Pitt Town.
Clifton	L. Smith, Soldiers' Settlement, Young.
Clovass	J. Boston, Tatham.
Cobbora	Robert Thomson, Cobbora.
Coradgery ...	W. S. Brown, "Estcourt," Parkes.
Coraki	G. A. Forrest, Coraki.
Cordeaux-Goondarin.	F. A. March, Kembla Heights.
Cotta Walla ...	T. A. Howard, Cotta Walla, Crookwell.
Cundletown ...	S. A. Levick, Roseneath, Cundletown.
Cunningham ...	B. J. Stocks, Linden Hills, P.O., Cunningham.
Dapto	L. Evans, Dapto.
Dural	C. J. Broissois, Dural.
Eulomogo ...	J. H. Stinson, Public School, Bunninyong.
Fairfield	H. P. Godfrey, Hamilton-rd., Fairfield West.
Garra & Pinecliff	S.W. Packham, "Clifton," Pinecliff
Gerringong ...	C. T. Hindmarsh, "Alne Bank," Gerringong.
Glen Innes ...	H. Osborne, Kingston, Glen Innes.
Glenfield	L. Bullus, Glenfield.
Glenorie	G. Hitchcock, Glenorie.
Griffith (Beelbangera).	A. C. McKern, Coolooli, Griffith.
Hannam Vale ...	W. Buttsworth, Hannam Vale, via John's River.
Henty	F. H. Schultz, Henty.
Holbrook	J. C. Hayes, Holbrook.
Inverell	W. A. Kook, Rock Mount, Inverell.
Jilliby-Dooralong	K. A. Smith, Jilliby, Wyong.
Kellyville... ...	J. M. Firth, Kellyville.
Leech's Gully ...	James Donnelly, Leech's Gully.
Lidcombe	Geo. Feuner, Platform-st., Lidcombe.
Lisarow	A. L. Kelman, Lisarow.
Lower Portland	H. Hayward, Lower Portland.
Mangrove Mountain.	A. E. Lillicrap, Mangrove Mountain, via Gosford.
Matcham ...	John Dodd, Matcham.
Middle Dural ...	A. F. Best, Middle Dural.
Milbrulong ...	J. M. Gollasch, Milbrulong.
Miller's Forest	A. J. O'Brien, Miller's Forest.
Milton	C. Ingold, Yatte Yattah, via Milton.
Miranda... ...	A. C. Wigzell, Sutherland.
Mittagong ...	A. Shimmels, No. 11, Farm House, Mittagong.
Moruya	P. Flynn, Moruya.
Moss Vale ...	W. G. Bale, Moss Vale.
Mount Keira ...	W. Yates, Mount Keira, via Wollongong.
Mullumbimby...	W. G. Rollo, Glen Iris, Mullumbimby.
Narellan... ...	G. J. Richardson, Narellan.
Neilrex	W. P. Beaham, Neilrex.
Nelson's Plains	M. Cunningham, Nelson's Plains.
Nimbin	John Wilson, Nimbin.
North Berry Jerry.	H. Crawford, North Berry Jerry, via Coolamon.
Orangeville ...	W. J. Angilley, Orangeville, The Oaks.
Orchard Hills (Penrith).	K. Basedow, Orchard Hills, via Penrith.
Pambula... ...	J. A. Martin, Pambula.
Parkesbourne ...	S. W. McAlister, Parkesbourne
Peak Hill ...	W. H. Swain, River View, Peak Hill.
Penrose-Kareela	C. Aye, Penrose.
Quaker's Hill ...	W. Harper, Osborne-rd., Quaker's Hill.
Redbank ...	J.J. Cunningham, Redbank, Laggan.
Rydal	C. McAlister, Public School, Rydal.
St. Marys ...	W. Morris, Queen-st., St. Marys.
Sackville... ...	Arthur Manning, Sackville.
Spencer	H. J. Woodbury, Spencer.
Springside (via Orange).	W. P. Scarr, Springside.
St. John's Park	W. A. Bate, St. John's-rd., Canley Vale.
Stony Point ...	J. Smith, Stony Point, via Leeton.
Stratford ...	P. H. Deards, "Loch Maree," Stratford.
Tallawang ...	H. W. Graham, Tallawang.
Tallong	J. W. Hatter, Tallong.
Taralga	Dave Mullaney, Stonequarry, Taralga.
Tennyson (North Richmond).	W. S. Farlow, Richmond.
Thyra-Bunaloo...	W. Glen, "Minerva," Thyra-rd., Moama.
Tingha	R. C. Corey, Tingha.
Toronto	J. Froome, Knowle Farm, Toronto.
Walla Walla ...	H. Smith, Walla Walla.
Wallsend ...	P. Miller, Box 253, Newcastle.
Warrah Creek ...	J. T. Power, Warrah Creek, via Willow Tree.
Wellington ...	L. Jurd, Warne-st., Wellington.
Wentworthville	H. Druce, Berith-rd., Wentworthville.
Wetherill Park	A. J. Hodges, Wetherill Park.
Windsor	W. H. Spinks, Windsor.
Woonona ...	Jas. P. Fleming, Woonona
Yarramalong ...	J. Hedges, Yarramalong.
Yarrandale ..	A. H. Newton, Gulargambone.
Yurrunga & Avoca	M. Spain, Avoca P.O.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once

1921.

Society.	Secretary.	Date.
Cobargo A., P., and H. Society	T. Kennelly	Feb. 9, 10
Shoalhaven P. and A. Association (Nowra)	H. Rauch	,, 9, 10
Central Cumberland A. and H. Assoc. (Castle Hill)	H. A. Best	,, 11, 12
Ulladulla A. and H. Association (Milton)	R. F. Cork	,, 16, 17
Guyra P., A., and H. Association	P. N. Stevenson	,, 16, 17, 18
Fairfield Branch Agricultural Bureau	H. P. Godfrey	,, 17, 18
Blacktown and District A. Society	J. McMurtrie	,, 18, 19
Wyong District A. Association	E. H. Chapman	,, 18, 19
Dapto A. and H. Society	F. James	,, 18, 19
Luddenham A. and H. Society	C. C. Wallace	,, 18, 19
Bangalow A. and I. Society	W. H. Reading	,, 22, 23
Yanco Irrigation Area Agricultural Society	R. Tribe	,, 22, 23
Robertson A. and H. Association	E. S. Martin	,, 22, 23
Southern New England P. and A. Association (Uralla)	H. W. Vincent	,, 22, 23, 24
Dorrigo and Guy Fawkes A. Association	A. C. Newman	,, 23, 24
Gunning P., A., and I. Society	S. A. Beer	,, 23, 24
Nambucca A. and H. Association (Macksville)	M. Wallace	,, 23, 24
Newcastle A., H., and I. Association	E. J. Dann	,, 23 to 26
Hastings River A. and H. Society (Wauchope)	A. D. Suters	,, 24, 25
Berry A. Association	O. R. Smith	,, 25, 26
Nepean District A., H., and I. Society	C. H. Fulton	,, 25, 26
Gulgong A. and P. Association	D. H. Spring	Mar. 1, 2
Tamworth P. and A. Association	J. R. Wood	,, 1, 2, 3
Tenterfield P., A., and M. Society	E. W. Whereat	,, 1, 2, 3
Manning River A. and H. Association (Taree)	R. N. Stow	,, 2, 3
Mirrool (M.I.A.) A. Society (Griffith)	F. A. Browne	,, 2, 3
Richmond River A., H., and P. Society (Casino)	P. M. Swanson	,, 2, 3
Taralga A., P., and H. Association	J. J. Kearney	,, 2, 3
Tumut A. and P. Association	T. E. Wilkinson	,, 2, 3
Walcha P. and A. Association	J. R. Conley	,, 2, 3
Oberon A., H., and P. Association	C. S. Chudleigh	,, 3, 4
Hunter River A. and H. Association (West Maitland)	E. H. Fountain	,, 3, 4, 5
Berrima District A., H., and I. Society (Moss Vale)	J. W. Kenny	,, 3, 4, 5
Camden A., H., and I. Society	A. E. Baldock	,, 3, 4, 5
Bellinger River A. Association	J. F. Reynolds	,, 4, 5
Mudgee A., P., H., and I. Association	E. J. Hannan	,, 8, 9, 10
Glen Innes P. and A. Society	Geo. A. Priest	,, 8, 9, 10
Moruya A. and P. Society	H. P. Jeffery	,, 9, 10
Tumbarumba and Upper Murray P. and A. Society	E. C. Cunningham	,, 9, 10
Gloucester P., A., and H. Society	F. H. Chester	,, 10, 11
Cooma P. and A. Association	C. J. Walmsley	,, 10, 11
Goulburn A., P., and H. Society	F. D. Hay	,, 10, 11, 12
Batlow A. Society	C. S. Gregory	,, 15, 16
Armidale and New England P., A., and H. Assocn.	A. H. McArthur	,, 15 to 18
Upper Hunter P. and A. Association	R. C. Sawkins	,, 16, 17
Gundagai P. and A. Society	H. W. Simpson	,, 16, 17
Macleay A., H., and I. Association (Kempsey)	E. Weeks	,, 16, 17, 18
Queanbeyan P. and A. Association	J. G. Harris	,, 23, 24
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 21 to 30
Upper Manning A. and H. Association (Wingham)	D. Stewart	April 13, 14
Narrabri P., A., and H. Association	C. C. Baker	,, 13, 14, 15
Orange A. and P. Association	G. W. Williams	,, 13, 14, 15
Clarence P. and A. Society (Grafton)	L. C. Lawson	,, 13 to 16

[Subsequent fixtures are noted but held over.]

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Agricultural Gazette of New South Wales.

Farmers' Experiment Plots.

WHEAT, OAT, AND BARLEY EXPERIMENTS, 1920.

North-western District.

MARK H. REYNOLDS, Inspector of Agriculture.

THE yields of wheat obtained throughout this district in the harvest just completed are perhaps the best ever recorded. Notwithstanding considerable lodging and rust, it was not uncommon for a return of 40 bushels per acre to be obtained. Considering the variable yields of the past few years, however, it is evident that, with the exception of the Inverell and New England sections, the district cannot be regarded as ideal from the wheat-grower's point of view. The distribution of the rainfall throughout the year is not, as a rule, such as to be of most use to the crop, and harvesting is often delayed and prolonged by falls at that period. Many farmers have found a combination of fat-stock raising with cereal-growing to be more profitable.

The soils of the district cannot be surpassed for their richness in plant-food; indeed, they are in many localities too rich for cereal growing. For stock-raising it would be difficult to find a district more suited; with a normal rainfall, a luxuriant growth of native herbage occurs from autumn to spring, and throughout the spring and summer every shower sets the native grasses moving. The growth of herbage and grass often attains a height of 2 feet, and occasionally much more.

A few pastoralists and farmers have conserved in the past the bounty of nature, either as bush hay or silage, but the amount conserved may be likened to a drop of water in a bucket. The records show that in every good season following a drought, the country is covered for miles with herbage or grass according to when the rain occurs. In the season just closed the amount of feed lost by tramping into the soil, etc., would, on a broad estimate, have carried the whole of the stock in the north-west for two years without any further growth. One must conclude that the reasons why more fodder is not conserved are that in the majority of seasons there is a sufficiency, that the land is relatively cheap, and that fewer stock are carried to the acre than in districts where land is utilised more for agricultural operations, and is of greater value.

Further work is needed along the lines of suitable rotations of crops, cultural methods and varieties of cereals, and other crops suited to the diverse soils and conditions of the district In these directions there is a large field open for investigation with excellent possibilities, either from a dry-farming or an irrigation-farming point of view. Concerning water supply,

there are wide stretches of country, principally traversed by the Namoi River, where shallow boring to 30 feet deep shows an abundant water supply, but little has been done so far to utilise this gift of nature. For stock purposes an abundant supply of water is provided over a large tract of country from deep-boring at Narrabri westward, and the whole district is well served with rivers and creeks that need only judicious weiring to provide amply for future droughts.

The district is so extensive and has such a variety of conditions of climate, soil, and rainfall that practically the whole ambit of crops and fruits may be grown.

The following farmers co-operated with the Department in carrying out the 1920 variety trial of cereals:—

W. H. Lye, Loomberah, via Tamworth.
J. T. Maunder, "The Wilgas," Pallamallawa.
Wm. Lennox, "Clairmont," Baan Baa.
O. J. Perry, Inverell-road, Armidale.
W. Butt, Red Bank Farm, Guyra.
Bignold Bros., "Arlington," Manilla.
R. A. Warden, Mount Russell.
J. Perry, "Killara," Quirindi.
J. C. Ormiston, "Glenfenzie," Gunnedah.
Jas. Cherry, "The Willows," Wee Waa.
E. Bower, "Hampton Valley," Warialda.
Wm. Palmer, "Pine View," Narrabri.
R. A. Studd, "Glenair," Boggabri.
Wm Bridge, Quipolly.
Wm. Tonkin, "Garfield," Little Plain, Delungra.

The following table shows the rainfall at the various centres for the growing period. No records were obtained from Quipolly and Delungra; in the latter case, however, the falls at Mount Russell will serve as a general indication.

Month.	Tamworth.	Baan Baa.	Manilla.	Wee Waa.	Warialda.	Narrabri.	Mount Russell.	Gunnedah.	Pallamallawa.	Boggabri.
	pts.	pts.	pts.	pts.	pts.	pts.	pts.	pts.	pts.	pts.
April	...	66	...	...	..	...	...	...	...	...
May	...	147	25	...	31	...	...	...	110	...
June	705	590	712	...	318	782	472	658	510	..
July	370	274	169	97	75	597	368	461	316	267
August	278	120	317	123	273	122	202	239	119	151
September ...	293	256	297	168	202	188	221	256	280	304
October	170	77	145	200	306	205	231	158	423	189
November ...	152	...	169	79	..	...	144	109	51	83
Total ...	1,968	1,530	1,834	667	1,205	1,897	1,638	1,881	1 809	994

The Plots in Detail.

Mount Russell.—Mount Russell is about 14 miles from Inverell, and has an elevation of 2,200 feet; the country is undulating. The soil of the plots is a dark chocolate loam, reasonably free working, of basaltic origin, and typical of

a large area of the surrounding country. The site occupied by the plots was sown in 1919 to barley for green feed. This was, however, fed off early, and subsequently died out owing to the drought. In February, 1920, the land was ploughed 4 to 5 inches deep, and on 21st May the plots were sown without manure. A good germination resulted, and on 3rd and 4th August the growth was fed off by sheep, a mob of 500 being turned on to the paddock of 30 acres of wheat in which the plots were situated.

A good crop of Bomen Wheat at Mount Russell.

On 16th November the several wheats looked magnificent, being in the advanced hay stage, standing up well in height from 3 ft. 6 in. to 4 ft. 6in., having only a minor growth of weeds in the crop, and being free from black oats. Each variety was as level as a board. At this time Federation was markedly showing rust on stem and flag, causing slight pinching of the grain, but the other varieties were virtually free.

The wheats were fit to harvest in the beginning of December, and were harvested on 12th and 14th of that month. All varieties were f.a.q., Canberra weighing 65 lb., and Bomen weighing 67 lb. to the bushel.

Pallamallawa.—This locality is 7 miles from Biniguy on the Moree-Inverell railway, and has an elevation of 900 feet above sea-level. The country is undulating, and the soil a red loam, fairly free working. The crop previously grown on the site of the experiment was wheat, which had been sown in 1919, but had failed. The 1920 plots were sown on 25th and 26th May in a good seed-bed. No after-cultivation was given, and feeding-off was not resorted to. The wheats attained a height of from 3 feet 6 inches to 4 feet, but lodged in patches, the worst in this regard being Canberra. Rust was most prevalent in Federation, and to a less extent in Hard Federation, causing pinched and light grain in the former. The crop was harvested from 10th to 30th November.

Warialda.—The plot was located 15 miles from Warialda, at an elevation of about 1,100 feet, and on undulating country, with a red, sandy, free-working loamy soil. Yandilla King, Bomen, Currawa, and Marshall's No. 3 were sown on 18th May, and the other varieties on 27th June, on land that had been ploughed two months earlier. Feeding-off was not resorted to, and prior to harvesting, which took place on 25th November, all the wheats that yielded well (particularly Canberra) lodged to a minor extent. The grain of Federation was badly pinched, and that of Hard Federation slightly so from the effects of rust.

Wee Waa.—These plots were situated at an elevation of about 650 feet, on undulating and level country, consisting of a red, sandy, free-working soil. The land was ploughed shortly before sowing on 20th July. The wheats were not fed off. and attained a height of 2 feet 9 inches to 3 feet 6 inches. Federation was badly affected with rust, which, together with the late sowing, also affected the grain of Marshall's No. 3. Harvesting took place on 8th December. Slight lodging also occurred.

Quipolly.—Situated on level country, with an elevation of 1,200 feet, the soil at this centre was subject to flooding, and was not typical wheat land. The wheats were sown on 13th and 14th August, and were harvested on 30th December. Feeding off was not resorted to. All the varieties lodged in patches, and were more or less affected by scalding (due to the land being swamped and subsequently setting hard) and by rust. The best quality grain was from Canberra, Currawa, and Hard Federation in the order named.

Narrabri.—Located on slightly undulating country, at an elevation of 700 feet; soil, chocolate loam. In 1919 the 30-acre paddock (in which the plots were located this year) was sown to wheat with an application of 56 lb. of ground rock phosphate to the acre. The wheat failed owing to dry weather, and this year this paddock yielded considerably better than any other paddock on the farm, due no doubt to the application of the ground rock phosphate in 1919.

The varieties were sown in June, and harvested from 8th November. Feeding off was not resorted to. Canberra lodged in patches, and rust reduced the yield and pinched the grain of Federation.

Manilla.—Situated on undulating country, at an elevation of 1,300 feet, the soil being a free-working red loam. The previous crop was wheat, which failed in the drought of 1919. The plots were sown on 20th and 21st May. They were not fed off, and lodging occurred in all varieties. Canberra was most severely affected, and fully half the crop was lost. Bomen and Federation stood up best. Harvesting took place on 21st and 25th November, and a great loss of grain resulted for the want of a reaper-thresher.

Baan Baa.—Situated on undulating country, consisting of red sandy loam; elevation, 800 feet; wheat sown, 1st April, and harvested 8th December.

The crop was not fed off, and averaged 4 feet high. All varieties stood up well, excepting Canberra. The grain of all varieties was of good quality. The previous crop was wheat, which failed.

Boggabri.—Situated on slightly undulating to level country at 800 feet elevation; soil, dark red loam overlying clay subsoil about 7 inches from the surface; previous crop, wheat, which failed. Sowing occurred on 28th June and 10th July. Rust caused pinched and light grain, except in Currawa, Canberra, and Hard Federation, which were the least affected, and were above f.a.q. Harvesting occurred on 16th December.

Tamworth—Situated about 14 miles east from Tamworth on undulating country; elevation, about 1,300 feet; soil, free-working red loam. The 1919 crop was wheat. The long season varieties were sown on 5th May, and the short season ones on 12th August. Feeding off was not resorted to, but the wheats were standing well until 1st December. From then to 9th December, 440 points of rain fell and caused considerable lodging and damage. A great quantity of grain could not be harvested. Apart from the varieties tested for the Department, Mr. Lye, the experimenter, had a number of other varieties on trial, the most promising being America 8.

Delungra.—Situated on undulating country, at an elevation of about 2,000 feet; a dark chocolate and black heavy volcanic soil, rich in plant food, which contracts considerably in drying, causing the surface to crack and break up into somewhat coarse particles. The land was sown to wheat in 1919, but the crop failed. The wheat plots were sown on 7th May, and harvested on 23rd November. They grew 5 to 6 feet high and lodged considerably. No feeding-off was resorted to. Rust affected Federation and Bunyip, but with exception of Federation, the quality of all the other grains was very good. Lodging was greatest in Currawa, Cleveland, and Florence.

Gunnedah.—Situated on undulating country at an elevation of about 900 feet; soil, red free-working loam. The crop of wheat the previous year failed. The plots were sown on 5th June, and harvested on 23rd and 24th December. The wheats were not fed off, and attained a height of 3 to 4 feet. They stood up well to harvest, excepting small patches. Federation was affected by rust, the other varieties being practically free. Bomen was slightly pinched. The quality of the grain of all other varieties was very satisfactory.

Quirindi.—Situated on level country, subject to flood; soil, a dark, free-working, rich loam. The heavy rains of June and July damaged the crop, and later rains caused extensive lodging, so that no comparative results were possible.

Dumaresq and Guyra.—The experimenters cut these partly for hay and partly for threshing at a later stage for grain. These districts do not grow wheat for grain sufficiently to warrant further grain trials in the near future. They are more interested in tests with oats.

General.

No manure was supplied on any of the plots. The results show that generally, where Federation was sown before June, it was not seriously affected by rust. The reaper-thresher harvester played a useful part in saving a large percentage of the grain from lodged crops.

RESULTS of Wheat Variety Trials.

Variety.	Tamworth.	Baan Baa.	Manilla.	Wee Waa.	Warialda	Narrabri.	Quipolly.	Mount Russell.	Gunnedah.	Pallamallawa.	Delungra.	Boggabri.
	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.
Marshall's No 3...	*	36	27¼	16	34½	30	22½	44¾	23	28½	...	26
Yandilla King ...	*	37½	27	19½	38½	36¾	24½	..	29	:8½	...	28
Federation ...	30	33¾	28½	12	14¾	24¾	19¼	37¾	23¾	26½	31	15
Hard Federation	31½	41½	30¾	23	24	46¾	28	...	31½	31½	37¾	33
Canberra . ..	36	46	23¾	29	37½	42	20	55	28½	52	27¾	35
Florence	*	...	...	...	..	...	...	...	.	34½	26¾	...
Bomen	*	43½	32½	25	32	33¾	21	44	21¼	34½	33½	...
Bunyip	*	...	...	...	26½	...	...	...	...	27	24	...
Currawa	*	37½	26	21½	33½	33	20¾	...	28¼	...	24	28
Genoa	*	...	...	...	...	...	5¾	...	...	.	...	16
Gresley	*	...	31¼	20	...	...	20	...	22	...	..	27
Marquis	23	...	...	.	...	...	12	31¾	...	28½	...	18
Sunset	...	...	...	...	...	...	...	...	...	37½	...	...
Clarendon ...	...	...	...	...	...	...	..	.	...	37½	...	...
Cleveland ...	...	...	..	...	...	...	...	...	...	...	36¾	...

* Badly damaged.

Malting Barley.

The 1920 season for oats and barley in the north-western districts was generally very unsatisfactory, owing to the crops lodging, through being very weak in the straw, owing to the favourable growing conditions. Not only on the experiment plots, but elsewhere also, lodged, tangled crops of barley and oats were the rule.

The areas of barley were not extensive, but a considerable number of farmers had from 10 to 50 acres under crop, having been encouraged to plant by the various brewers. More often than not the most satisfactory method of garnering the grain is to cut the crop with the reaper and binder when the grain is still in the dough stage and to protect the sheaves either by careful stooking or stacking until fit to thresh. The average farmer depends on stripping to garner, and the season just closed was not suited to this method. The loss from lodging, together with the relatively low market price of barley, will cause a big reduction in cropping next year.

Plots were established at the following centres:—

W. H. Lye, Loomberah, via Tamworth.
J. T. Maunder, Pallamallawa.
R. A. Studd, Boggabri.

The varieties tested were: Kinver, Goldthorpe, Golden Grain, and (at Tamworth only) Mackie's Chevalier.

Tamworth.—Soil, well prepared red loam, overlying retentive subsoil about 10 inches from the surface. No manure applied; sown 7th May, 1920. Yields per acre: Kinver, 39¾ bushels; Goldthorpe, 35¼; Golden Grain, 41; Mackie's Chevalier, 34.

A rate of seeding trial was conducted at this centre (variety, Chevalier) with the following results:—

Sowing at 30 lb. seed per acre yielded	33 bushels	15 lb.
" 40 lb. " " "	34 "	10 "
" 50 lb. " " "	34 "	46 "

Of the three centres, the results here were most satisfactory. They give no indication of the yield of farmers' crops generally in the Tamworth district, the plots being harvested prior to 12th December, when there were four wet days. The rain caused great damage to all crops not harvested, and affected the majority of those in the district.

Smut was prevalent, especially in Goldthorpe.

Pallamallawa.—Sown 25th and 26th May; harvested 10th to 30th November. No manure applied. The plots here were very promising to within a fortnight of maturing, when caterpillars caused destruction. Heavy rain followed by high velocity wind caused extensive lodging, and only small portions of the crop were saved. Smut was also prevalent in this plot.

Boggabri.—Sown 28th June; harvested 16th December. Only portion of the crop was saved, damage being caused by conditions similar to those at Pallamallawa. Goldthorpe yielded 32 bushels per acre, and Kinver 19 bushels.

Oats.

Plots were established at the following centres:—

W. H. Lye, Loomberah, via Tamworth.
J. T. Maunder, Pallamallawa.
R. A. Studd, Boggabri.
W. Lennox, Baan Baa.
O. J. Perry, Armidale.
Hill, Robertson, and Butt, Guyra.

The varities used were Sunrise, Algerian, Guyra, and White Tartarian.

Tamworth.—Sown, 10th May; harvested, 18th December. This crop was most promising until 10th December. Later, lodging was caused by four days' rain, and only a portion of the crop was saved. Yields per acre:—Algerian, 38 bushels 20 lb.; Sunrise, 36 bushels 10 lb.; Guyra, 35 bushels 25 lb.

Pallamallawa.—Sown, 25th and 26th May. Lodged so badly that only a few bushels were harvested, and no comparative results were obtainable.

Boggabri.—Sown, 28th June. Likewise lost through extensive lodging.

Baan Baa.—Sown, 1st April. Excellent growth and promise of high yield of grain until late in November, when rain storms completely flattened the crop, and little seed was saved.

Guyra and Armidale.—The several varieties were cut for threshing, and the results will not be available for some time.

Central Western District.

W R. BIRKS, B.Sc. (Agric.), Inspector of Agriculture.

THE farmers who undertook to conduct the cereal experiment plots for hay and grain in this district for the season just past were:—

G. J. Douglas, "Fairfield," Coonabarabran.
Granowski Bros., "Mooren," Binnaway.
J. Mathias, Oban Soldier Settlement, Coolah.
Robinson Bros., Tallawang.
F. S. Stacey, "Combandry," Gulgong.
J. Welsh, Mudgee.
N. S. Meek, Hobby's Yards.
H. Leabeater, Lyndhurst.
H. J. Thompson, "Tilga," Canowindra.

The Season.

In common with other districts the fallow period and sowing time were exceptionally dry, and all early sown crops throughout the district came away together after the early June rains. The subsequent distribution of the useful rainfall is indicated in the following table:—

	June.	July.	August.	September.	October.	November.	Total.
	inches.	inches.	inches.	inches.	inches.	inches.	inches.
Coonabarabran ...	12.16	7.16	2.65	3.60	.99	2.26	28.82
Coolah	5.78	9.56	2.27	2.19	.53	1.80	23.13
Tallawang ...	7.57	5.33	2.55	4.33	.64	1.94	22.36
Gulgong	4.32	5.16	2.49	1.60	.66	2.83	17.06
Mudgee	5.61	5.16	3.58	3.57	.60	...	19.02
Hobby's Yards ..	5.42	3.49	5.14	3.42	1.55	1.14	21 28
Lyndhurst ...	5.46	3.64	5.76	3.10	2.34	...	20.87
Canowindra ...	4.05	2.83	3.10	2.27	1.88	.75	14.88

Thus the winter months were abnormally wet and the August and September rainfall sufficient; October was sufficiently dry to ward off the threatening attacks of rust, though this was scarcely so in the cooler, later districts (for example, Coonabarabran) as far as late sown crops were concerned. Susceptible varieties such as Federation, especially when sown after the middle of June, suffered very seriously as a result of rains in the middle of November, and eventually in some instances as much as 80 per cent. of the promised yield was lost. The plots under consideration, however, were all planted in good time, and although some loss no doubt occurred, nothing approaching a complete failure was experienced.

The "finishing" rains were everywhere satisfactory.

Under these circumstances no special inferences can be drawn from different methods of preparation of the land prior to seeding. The benefits of fallowing were completely marked as regards yields, but by no means so in point to cleanliness and freedom from such diseases as smut and take-all.

The heavy weather generally experienced throughout December not only reduced the yields (in some instances to the extent of two bags or more per acre), but also impaired the value of the results as an indication of the relative

yielding capacities of varieties. In some cases the harvesting of the plots themselves extended over a period of a week or more, and the losses due to rain were by no means uniform.

The Yields.

The actual results of the various tests are set out in the following tables :—

WHEAT Variety Trials—Grain.

	Binnaway.	Tallawang.	Coolah.	Coona-barabran.	Gulgong.	Canowin-dra.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Canberra	45 30	38 20	29 50	27 10	29 20	......
Yandilla King ..	40 40	29 10	40 10	24 25	......	21 20
Hard Federation ..	39 30	35 20	26 30	21 30	30 10	25 0
Federation ...	35 25	36 30	......	......	28 45	27 30
Marshall's No. 3 ..	39 50	27 40	33 15	26 50	21 25	13 10
Currawa	29 15	34 50	27 0	......	......	24 40
Gresley	33 0	......	......	......	24 0	......
Firbank	26 10	......	......	23 40	......	......
Penny	23 35	......	......	......	......	26 25
Florence	22 20	24 40	......	31 50	18 0	......
Marquis	......	......	30 45	17 50	......	......
Genoa	......	......	......	23 45	......	......

WHEAT and Oat Variety Trials—Hay.

	Hobby's Yards.	Lyndhurst.	Mudgee.
	t. c. q.	t. c. q.	t. c. q.
Wheats—			
Canberra	2 5 0	......	3 3 0
Florence	......	......	3 1 2
Marshall's No. 3 ...	4 4 1	......	2 8 1
Zealand	......	......	3 1 1
Firbank	......	......	3 0 2
Yandilla King	2 18 0	......	2 15 1
Oats—			
Algerian	4 6 2	......	......
Guyra	4 5 0	3 12 1	......
Lachlan	......	4 3 3	......
Ruakura	......	3 13 3	......
Sunrise	3 13 1	3 11 3	......

OAT Variety Trials—Grain.

	Coonabarabran.	Tallawang.
	bus. lb.	bus. lb.
Sunrise...	40 10	.....
Algerian	30 25	17 30
Guyra	28 35	22 20

The results, taken generally and in conjunction with the experience of many farmers throughout the district, indicate somewhat of a triumph for Canberra, Yandilla King and Hard Federation wheats, and for Sunrise oats. These are varieties that are usually relied upon to stand adverse conditions in the form of drought, and it is a striking tribute to their general excellence that they were able not only to respond to the favourable conditions of growth of a season such as that just passed, but also to "stand up" in unfavourable harvesting weather. It is, further, a fortunate and creditable accomplishment in the development of local varieties, that this group of cereals fulfils the normal requirements of the average farmer of the district, viz., an early, late, and mid-season wheat, and a hardy, quick-maturing oat.

Federation still maintains its pride of place only in certain localities, and those usually the more favoured as regards rainfall; while Marshall's No. 3, Zealand, and Florence show special adaptability as hay wheats in certain localities.

MANURIAL TRIALS.

	Hobby's Yards. Sunrise Oats for Hay.	Canowindra. Hard Federation Wheat for Grain.
	t. c. q.	bus. lb.
No manure	3 7 2	20 25
28 lb. Superphosphate ...	....	23 10
42 ,, ,, ...	....	25 0
56 ,, ,, ...	3 13 1	20 40
56 ,, Basic Superphosphate ...	....	20 50
84 ,, Superphosphate ...	4 3 0	....
112 ,, ,, ...	3 18 2	....
117 ,, P 7 Mixture	4 3 3	....

These trials are too incomplete and isolated to allow of general deductions. However, there is indicated the advisability of employing light dressings of superphosphate (up to ½ cwt. per acre) in the general wheat-growing areas, whereas in the cooler districts on the tablelands heavier dressings will probably give remunerative returns.

RATE of Seeding Trials.

	Gulgong.	Canowindra.	Tallawang.
	bus. lb.	bus. lb.	bus. lb.
42 lb. per acre	27 0	26 40	34 20
60 ,, ,, ...	30 10	25 0	35 20
72 ,, ,, ...	33 10	18 30	22 25

The variety used was Hard Federation in all three cases.

Western District.

H. BARTLETT, Assistant Inspector of Agriculture.

WHEAT and oat variety trials were conducted with the undermentioned farmers during the season 1920:—

D. A. Rich, "Rozalene," Curra Creek, Wellington.
L. J. Broughton, "Berrimah," Mendooran.
J. Parslow, Collie-road, Gilgandra.
W. Werner, "Pinefield," Nymagee.
E. P. Quinn, "Tarella," Narromine.
S. Reilley, junior, "Eurimbla," Roadside, Eurimbla.
E. J. Allen, Gregra.
W. W. Watson, "Woodbine," Tichborne.
R. Shelton, Elm Vale, Nelungaloo.
E. A. Draper, Harris Park, Alectown West.
J. M. Connor, Ootha.
R. J. O. Berryman, Botfields.
M. F. Dalton, "Duntry-league," Orange.

Cultural Notes.

Wellington.—Mouldboard-ploughed 4 inches deep, December, 1919; cultivated with spring-tooth, February and March. Sown, 3rd June with 60 lb. wheat seed and 84 lb. superphosphate per acre. Harrowed during August.

Mendooran.—Disc-ploughed 4 inches deep, October, 1919; harrowed, February; cultivated with spring-tooth, February. Sown, 6th, 7th, and 8th May, 1920, with 45 lb. wheat, 50 lb. oats and 42 lb. superphosphate per acre.

Gilgandra.—Ploughed first week in December, 1919; harrowed, February; cultivated with spring-tooth, April. Sown, 3rd and 4th May, 1920, with 60 lb. wheat, 50 lb. oats and 28 lb. superphosphate per acre.

Narromine.—Disc-ploughed 4 inches deep, September; cultivated with spring-tooth, January and April and just prior to sowing. Sown, 21st and 22nd June, 1920, with 45 lb. wheat, 60 lb. oats (unmanured) and 30 lb. superphosphate per acre.

Eurimbla.—Mouldboard-ploughed 5 inches deep, December, 1919; cultivated with spring-tooth, March. Sown, 19th April, 1920, with 60 lb. wheat and 56 lb. superphosphate per acre.

Gregra.—Disc-ploughed 4 inches deep, December, 1919; harrowed December; cultivated with spring-tooth, March and April. Sown, 18th May with 60 lb. wheat, 60 lb. oats and 28 lb. superphosphate per acre.

Tichborne.—Ploughed December, 1920; cultivated with spring-tooth, June. Sown, 3rd June, 1920, with 60 lb. wheat and 56 lb. superphosphate per acre.

Nelungaloo.—Disc-ploughed 4 inches deep, September, 1919; cultivated with spring-tooth, December and April. Sown, 19th and 20th April with 60 lb. wheat, 60 lb. oats (except Sunrise 80 lb.), and 28 lb. superphosphate per acre.

Alectown West.—Mouldboard-ploughed 4 inches deep, September, 1919; harrowed, December and March. Sown, 17th and 18th March, 1920, with 60 lb. wheat, 60–70 lb. oats, and 20 lb. superphosphate per acre.

Ootha.—Ploughed 4 inches deep, July, 1919; cultivated with spring-tooth, April. Sown, 28th and 29th April, 1920, with 45 lb. wheat, 50 lb. oats, and 50 lb. superphosphate per acre.

Botfields.—Mouldboard-ploughed 5 inches deep, November; cultivated with spring-tooth, January; harrowed, April. Sown, 21st and 22nd May, 1920, with 45 lb. wheat, 40–50 lb. oats per acre. No superphosphate.

RESULTS of Variety Trials.

Variety.	Wellington.	Mendooran.	Gilgandra.	Narromine.	Eurimbla.	Gregra.	Tichborne.	Nelungaloo.	Alectown West.	Ootha.	Botfields.
	bus lb.	bus. lb.	bus lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Canberra	10 41	32 3	38 59	10 42	55 48	26 45	28 26	34 16	31 16	26 57	38 43
Hard Federation ..	..	34 47	36 56	30 28	..	27 47	23 53	26 26	23 5	24 22	32 47
Federation ..	18 29	32 6	35 39	9 22	39 2	28 6	..	23 46	27 47	26 53	29 48
Yandilla King ..	..	30 7	..	5 39	38 4	28 40	..	23 42	29 16	..	..
Marshall's No. 3 ..	15 55	29 9	..	4 32	..	..	..	21 58	..	..	..
Currawa	..	34 3	38 1	7 0	32 18	27 18	24 7	..	..	..	..
Bomen	..	..	..	..	..	21 38	22 10	17 38	..	27 35	..
Bunyip	..	29 35	..	..	..	..	..	22 55	..	25 50	33 46
Florence	..	36 36	..	4 14	..	..	..	28 33	24 49	..	..
Penny	..	..	..	..	..	26 14	29 46	..	..	..	..
Firbank	..	..	..	3 50	..	..	..	..	..	..	..
Gresley	..	..	..	..	..	..	..	..	..	27 18	31 18
Marquis	..	..	..	..	..	..	..	..	21 41	..	..
Red Wings ..	10 42	..	..	..	..	..	..	..	..	..	..
Algerian oats) ..	..	..	..	Nil.	..	..	..	37 7	Nil.	..	..
Sunrise ,, ..	..	50 17	33 2	,,	..	44 30	..	20 2	,,	..	28 5
Guyra ,, .	..	40 38	..	,,	..	..	..	39 38	,,	..	33 46
[illegible] rley) ..	..	..	..	..	..	..	..	.	19 3	..	..

Manurial Experiments.

Manurial trials with superphosphate in varying quantities were conducted, with the following results:

Locality.	Variety.	No Manure.	Superphosphate per acre. 20 lb.	28 lb.	30 lb.	40 lb.	42 lb.	50 lb.	56 lb.
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Mendooran ..	Canberra.. ..	27 31	29 20	..	..	..	32 3	..	34 50
Nelungaloo ..	Hard Federation	20 33	..	26 26	..	..	27 56	..	23 14
Alectown West ..	,, ,,	24 2	26 56	..	23 5	26 58	..	..	..
Ootha	Canberra..	19 47	..	..	..	..	..	26 57	..
Narromine ..	,, ...	5 56	..	..	10 42	10 2	..	12 26	..
Nymagee.. ..	,, ...	*	..	..	..	..	..	..	..

* See hay yields.

Rate of Seeding Experiments.

A rate of seeding experiment with Hard Federation wheat was conducted by Mr. E. J. Allen, Gregra, and resulted as follows:—

Seed per acre.	Yield.	Seed per acre.	Yield.	Seed per acre.	Yield.
lb.	bus. lb.	lb.	bus. lb.	lb.	bus. lb.
47 ...	31 24	60 ...	27 47	77 ...	31 0

Variety Trials for Hay.

Hay variety trials were conducted in three districts, the yields being as follows:—

Locality.	Variety.	Yield per acre.			
		t.	c.	q.	lb.
Orange	Turvey (wheat)	3	7	3	18
	Bomen	3	8	3	4
	Algerian (oats)	3	11	2	21
Nymagee	Canberra (wheat)*	2	14	0	0
		2	15	0	0
		2	16	1	0
		2	17	2	0
	Florence†	2	12	2	0
	Gresley	3	2	0	0
	Hard Federation	2	11	1	0
	Federation	2	4	3	0
	Sunrise (oats)	3	5	3	0
	Guyra	2	17	3	0
	Algerian (left for grain)	32 bus. 33 lb.			
		t.	c.	q.	lb.
Mendooran	Firbank (wheat)	1	14	1	10
	Florence	1	11	2	18
	Hard Federation	1	16	3	15
	Bomen	1	8	3	6
	Yandilla King	1	17	2	12
	Sunrise (oats)	1	15	0	4
	Algerian	1	8	3	13
	Guyra	1	15	1	6

* These plots of Canberra wheat were manured with 30, 40, 50, and 60 lb. superphosphate respectively.
† This plot was manured with 30 lb. superphosphate.

Notes on Varieties.

The wheats that have been most successful during the past season are Canberra, Hard Federation, and Federation. Canberra is a recently produced variety; it is suitable for all parts of the western district, and promises to exceed in popularity even the well-known Federation. Hard Federation is also greatly in demand, and many of the record yields have been obtained with it. Gresley is a promising variety, and yielded well where tried. Marquis is not recommended for the western district. It may be mentioned that in the variety trials at Narromine, Hard Federation was harvested prior to the December rains; the remainder of the wheats were not harvested till January, and were lodged so badly that only a small proportion of the grain was secured.

The oat variety trials were not a success, the plots being damaged by the December rains to such an extent that it was impossible in some cases to harvest them, while in others only a portion of the grain was secured.

In all cases increased yields resulted from the application of superphosphate, and this practice can be confidently recommended. As to quantities, it may be reckoned that the drier the district, the less the amount necessary per acre. For example, 56 lb. per acre is recommended in the Wellington district, but only 40 lb. at Parkes, and only 28 lb. at Condobolin.

General Comments.

The past season has been abnormal in more than one respect. Prior to this season, yields of from ten to sixteen bags have seldom been anticipated and very rarely realised in the western district, but the harvest just past has resulted in such yields being the rule, and not the exception.

What can such high yields be attributed to? Hardly to the general high standard of farming methods as practised, for in many cases where the seed-bed was prepared from stubble land with the spring-tooth cultivator, yields were obtained equal to those from well worked fallow. To understand the significance of this fact, a study of the climatic conditions during the years 1918 to 1920 is necessary, for the facts will be still found to demonstrate the value of the fallow.

During 1919, a wise optimist assured farmers that droughts were essential for the success of the Australian rural industries; that apparently landholders' one aim was to take from the land and give nothing in return; and that a drought was nature's method of resting the land, enabling soluble plant-food to accumulate, and thereby to produce crops and pastures of untold abundance after the drought was broken. He argued that £1 lost during the dry spell was worth £2 when good seasons returned.

The optimist's views mostly provoked a derisive smile; the idea of profits that were to be deferred and multiplied made no appeal to the hard-up agriculturist, who was very sure that £1 in his pocket during 1919 was preferable to the prospect of £2 in 1921. But is the essential argument of the optimist far out? If the wheat-grower would only take nature's "tip," and farm with due regard for rainfall and climatic conditions, the hardships associated with droughts would be considerably lessened. In the inevitable prospect of recurring droughts there should be a decided incentive to the development of a scientific system of rotations and mixed farming.

The years 1918-19 were drought years. Crops were sown, and the small growth which resulted had no chance of producing a grain crop, and so was fed off to save starving stock. Owing to the absence of rain, the soil remained in a fairly open, loose condition; what growth of crop was produced was partly returned to the soil in the form of manure. In short, nature practically fallowed the land for two years, while the farmer had to use his wheat crop as a fodder crop. The farmer desired a wheat crop, and nature forced him to try mixed farming—wheat—fodder crop—fallow. Not a great success during 1918-19, perhaps; but what about 1920?

Fallowing not only conserves moisture. Plant-food must be in a soluble form before it can be utilised by plants, and it is continually becoming converted from the insoluble to the soluble form. This change takes place most rapidly when the soil is in an open, loose, and quiescent condition, such as obtains when it is resting under fallow. The soluble plant-food is not then washed from the soil, but is stored in such a way that the following crop gets the benefit of all that has become available during the preceding twelve months.

A large amount of moisture is necessary to produce a heavy crop. During 1920 the western district had ample during the growing period. Nature had fallowed for two years, and the farmer had also fallowed. Both fallows were dry at seeding time, and as the conditions of the seed-bed were almost equal, similar crop results were to be expected.

The rainfall during growth was ample; but without the forced fallow, and consequent storage of soluble plant-food, such high yields would not have been possible. The fact that fallowing conserves moisture is too well known to need comment, but it is desired to stress the point that fallowing also accumulates soluble plant-food. It may be remarked here that when the fallow is clean the best implement for preparing the seed-bed is the spring-tooth cultivator.

Another factor which contributed to the successful harvesting of such high yields after the severe storms of early December was the varieties of wheat that were grown. Fully 70 per cent. of the wheat grown in New South Wales consists of varieties produced by the Department of Agriculture. At times the Department has been criticised adversely for rejecting varieties that have yielded well in certain seasons, but it must be remembered that the aim of the Department is to produce varieties of all-round excellence, taking into consideration milling quality, yield, and resistance to disease and adverse weather conditions, and it must be obvious that unless a variety reaches the standard required it is unwise to recommend it.

A general guide when selecting varieties is that in the more favoured districts, such as Wellington and Molong, midseason and even late wheats may be safely grown, but where the rainfall is less, such as at Parkes and beyond, it is advisable to sow midseason and early wheats.

Further Reports on Shearman's Clover.

The identification of this clover as *Trifolium fragiferum* var., as reported previously in this journal, has now been confirmed by the Kew authorities. Of the promising reports recently received concerning it, the following are important:—

Mr. M Hemring, Smithtown, Tasmania—"The Shearman's clover which I planted on the swamp is a complete success. The land is indifferently drained. This year there was no warm growing weather until Christmas week, and up to that time strawberry clover and Shearman's made equal growth. Immediately the warm weather started, Shearman's clover sent out magnificent shoots and walked right away from the strawberry."

Mr. H. R Jones, Crabbe's Creek, North Coast—"Shearman's clover was planted in May in portion of a drained swamp. It is now making good progress and spreading rapidly."

Mr. R. V. Simpson, Stonehenge—"Shearman's clover is growing well in heavy black basaltic soil, and is decidedly promising."

The Director of Agriculture, Tonga, reports that this clover is growing well. Other reports and personal inspections show that it is doing well in swampy situations or moist soils at Grafton, Holbrook, Milton, Comboyne, and Richmond.—E. Breakwell, Agrostologist.

Field Experiments, 1920.

Grafton Experiment Farm.

H. BRYCE, H.D.A., Experimentalist.

[The Experiments Supervision Committee, under whose control these experiments are being conducted, wish to draw the attention of farmers to the fact that final conclusions cannot yet be drawn from these trials. The trials are conducted from year to year, and these interim results are published for the information of farmers.]

Wheat Variety Trial.

THE object of this experiment, which is being continued from year to year, is to determine the most suitable varieties of wheat to grow for quality and yield of hay in the Clarence River district.

The 1920 plots were one-eighth of an acre in area, and were situated on black alluvial soil of similar character to that of some of the Clarence River flats. Some of the varieties grown were not those usually recommended for hay on the coast, but they were used because of the shortage of seed of the varieties commonly grown for the purpose. It will be seen that though the crops were subjected to a severe test by the very wet season, the yields of these varieties were such as to render the crops quite profitable. In future years it is hoped that seed of more rust-resistant varieties will be available.

The experiment comprised a trial of four varieties, viz.:—Canberra, Hard Federation, Marshall's No. 3, and Thew. Canberra was sown on every third plot as a check.

Preparation and Sowing.—The land was ploughed up in November, 1919, and allowed to lie fallow for six months. Cultivations were given after each fall of rain to preserve the mulch and destroy weed growth. The land was disced and harrowed before being sown with a wheat drill on 15th May, 1920, at the rate of 56 lb. per acre. The soil was in excellent condition and germination on all plots was good.

The Season.—The season was an excellent one, and good rains fell throughout the growing period, though, on 16th and 17th September, heavy thunderstorms occurred and lodged the crops. Details of the rain which fell during the growing period of the crop were as follows:—May (15th to 31st), 22 points; June, 179 points; July, 309 points; August, 54 points; September, 368 points; October (1st to 4th), 4 points, making a total of 936 points.

Harvesting.—The crop was harvested on 5th October. Canberra gave the highest yield, and the remaining varieties yielded well. Rust was prevalent in all varieties, and Thew and Canberra were badly lodged.

The following table shows the yields per acre:—

Variety in Order of Merit.	Yield per acre (percentage yield).			
	t.	c.	q.	lb.
Average of check plots (Canberra)	4	3	1	12
Marshall's No. 3	4	1	2	21
Thew	3	19	0	21
Hard Federation	3	18	1	11

Winter Fodder Trial.

With the object of determining the most suitable cereal (or combination of cereal and legume), to grow for winter fodder in the Clarence River district, this experiment is carried out annually. The natural herbage of this district is at its lowest in the winter and early spring months, and some provision should be made by farmers to have a green fodder crop available to cope with this period of scarcity.

The area of each plot was one-eighth of an acre, and the experiment comprised a trial of three varieties of oats, Sunrise, Guyra, and Algerian ; two varieties of wheat, Marshall's No. 3 and Thew. Grey field peas and Golden vetches were the legumes used

Preparation and Sowing.—The land was ploughed in December, 1919, and allowed to lie fallow for three months ; frequent cultivations were given to conserve the moisture supplied by the heavy rains that were experienced during the months of December, January, and February, and to destroy weeds. Sowing was commenced on 26th March, 1920. The soil was in excellent condition, and the germination was good throughout. The field peas and vetches were sown by broadcasting them on their respective plots, and then, as the cereals were sown through the wheat drill, the drill covered the vetches and peas.

The combined rates of sowing were as follows:—Oats 36 lb. per acre, wheat 30 lb., field peas 20 lb., and vetches 15 lb. per acre. Sunrise oats was sown every third plot as a check at the rate of 56 lb. per acre. No fertiliser was applied to any plot.

The Season.—The season was an excellent one, and good rains fell throughout the growing period of the crop, as follows:—March (26th to 31st), 50 points ; April, 293 points ; May, 283 points ; June, 179 points ; July, 309 points ; August (1st to 13th), 34 points, making a total of 1,148 points.

Harvesting.—The plots were harvested with the reaper and binder, on 13th August. The Algerian oats, being a late variety, was not harvested till 15th September, to allow the crop to attain its full maximum height.

The following table shows the yields:—

Variety and rate of seeding per acre.	Yield per acre.			
	t.	c.	q.	lb.
Sunrise, 56 lb. (*Check*)	9	19	1	14
Sunrise, 36 lb., and vetches 15 lb...	10	16	2	24
Sunrise, 36 lb., and field peas 20 lb.	11	0	2	8
Sunrise, 56 lb. (*Check*)	9	8	2	8
Algerian, 36 lb., and vetches 15 lb.	8	19	2	24
Algerian, 36 lb., and field peas 20 lb.	9	1	1	24
Sunrise (*Check*)	9	17	1	24
Guyra, 36 lb., and vetches 15 lb.	10	1	3	12
Guyra, 36 lb., and field peas 20 lb.	10	3	2	24
Sunrise (*Check*)	9	13	0	16
Marshall's No. 3, 30 lb., and vetches 15 lb. ...	9	9	1	20
Marshall's No. 3, 30 lb., and field peas 20 lb. ...	9	12	0	16
Sunrise (*Check*)	9	16	0	16
Thew, 30 lb., and vetches 15 lb.	9	18	1	20
Thew, 30 lb., and field peas 20 lb.	9	19	0	12
Sunrise (*Check*)	9	12	2	24

Conclusions.—The varieties made excellent growth, and the field peas and vetches showed up well in the various plots. Sunrise oats and field peas produced the heaviest yield (as they did in the 1919 experiment). Guyra also yielded heavily, and the check variety (Sunrise oats alone) produced creditable yields. With the exception of Guyra, which was slightly affected, all varieties were free from rust.

Winter Fodder Manurial Trial.

A winter fodder manurial trial was carried out with the object of determining the most suitable fertiliser, or combination of fertilisers, to apply to winter fodder crops.

The land was ploughed in November, 1919, and cultivated to destroy weeds and conserve moisture. It was disced and harrowed on 12th May, and sowing was commenced on 15th May, 1920. Sunrise oats, sown at the rate of 60 lb. per acre, was the crop used. The manures were sown at the same time through the fertiliser attachment of the wheat drill. Check plots were left unmanured every third plot.

The growing period was the same as the wheat variety trial, and the rainfall table given above for that trial therefore applies to this experiment. Germination on all plots was good, and the crops made rapid growth.

Harvesting commenced on 5th October, and as the crop was badly lodged, considerable difficulty was experienced. The results were as follows :—

Fertiliser used per acre.	Yield per acre.				Increase over average of check plot.				Value of increase.*			Cost of increase.†			Net result per acre.	
	t.	c.	q.	lb.	t.	c.	q.	lb.	£	s.	d.	£	s.	d.	s.	d.
Superphosphate 2 cwt. ...	8	12	1	11	1	1	0	18	1	1	1	0	12	0	9	7 gain.
Bonedust 2 cwt.	9	2	3	20	1	11	2	27	1	11	7	1	4	0	7	7 ,,
Superphosphate 1 cwt. ...	8	1	3	2	0	10	2	9	0	10	7	0	6	0	4	7 ,,
Superphosphate 1 cwt. and nitrate of soda 1 cwt. ...	8	10	3	10	0	19	2	17	0	19	7	1	16	0	16	5 loss.
Average of check plot ..	7	11	0	21	....				......			......			......	

* Green fodder valued at £1 per ton.

† Superphosphate valued at 6s. per cwt., bonedust at 12s. per cwt., and nitrate of soda at 30s. per cwt.

A Grower's Testimony to Green Manuring.

Writing on the value of green manures in orchards on the Murrumbidgee Irrigation Areas, Mr. A. N. Shepherd, Assistant Inspector of Agriculture, related that Mr. J. Hetherington, Leeton, was very emphatic in his testimony to the benefit derived by his trees from a single crop sown and ploughed under last year. As a result, this settler intends this year growing green crops, preferably tick beans, right through the orchard. When it was suggested quite lately that the good season might have made the difference in his orchard this year, Mr. Hetherington very quickly pointed out a plot that had not had a crop ploughed in, and certainly the trees there did not look as well, nor had they made growth equal to those where the trial had been conducted the previous season.

Trials of Imported Cereals.

J. T. PRIDHAM, Plant Breeder.

In co-operation with the Royal Agricultural Society, the Department has in recent years imported from Canada and the United States several varieties of different cereals which are apparently being profitably grown in those countries, the object being to see how they would behave in New South Wales. They were tried last season at Cowra Experiment Farm, where it was patent that most of them were quite unsuitable for our conditions. Those that appear to have some possibilities of usefulness in this State will be continued under trial.

Oats.—The variety O.A.C. 72 was sown on 16th April, and headed nearly six weeks later than Lachlan, sown on the same day. The straw was coarse and the grain very pinched and thin.

Sixty Day came into head about the same time as Lachlan, but the straw is weak. As compared with Sunrise, the grain is light and the yield rather inferior. The variety cannot be recommended.

Fulghum is a very early oat, ripening quite as early as Sunrise, with a smaller head, but better stooling habit. The straw is of medium height, and the grain brown, rather plump and shorter than Algerian. It is worthy of further trial, and requires to be sown at the same time as Sunrise.

Banner came into head about the same time as O.A.C. 72, and, like that variety, it is too late for our climate. Even in the cooler districts other sorts would on the average give better returns.

Wheats.—In accordance with many years' previous experience, Early Red Fife and Glyndon Fife came into head at least five weeks later than such a variety as Hard Federation. They both have weak straw, and the grain shatters readily, though the quality of the grain is excellent when well grown.

Red Rock came into head five and a half weeks later than Hard Federation, and the grain was very pinched.

Kanred headed later than Red Rock, and is of apparently the same character.

Kharkov heads slightly later than Red Rock and Kanred. All three wheats are bearded and have rather weak straw. Their season of ripening is too late for our wheat districts.

Fultz is a beardless variety, four and a half to five weeks later than Hard Federation; it also is too late to be recommended for use here.

Marquis, sown on 16th April, came into head nearly a fortnight later than Hard Federation. This wheat has fairly strong straw, though slender, and does not shatter. It might be grown in the coolest wheat-growing districts of the State, but its yields have not yet justified its recommendation to farmers. The quality of the grain is excellent.

Burbank and Super, two wheats produced by Mr. Luther Burbank, of Santa Rosa, California, came with a very high reputation for yield, but tests here have shown that they come into head about six weeks later than Hard Federation, and produce light, pinched grain. They stool heavily with white felted heads and red-coloured, soft grain. They would be heavy yielders under favourable conditions, and might be of service to us when crossed with early varieties, but as they stand they cannot be recommended.

Mealy wheat is very like the above, all three being reported by Professor J. A. Clark, of the Bureau of Plant Industry, U.S.A., to be related to Jones' Winter Fife, a wheat we have grown in previous years and have proved unsuitable for our conditions.

Yeoman (the seed of which was received from Mr. J. P. Shelton (now studying in America), was produced by Professor Biffen. It headed six weeks later than Hard Federation and a fortnight later than Marquis. It is quite unsuitable for the wheat-growing areas of this State, though, judging by the head and stout straw, evidently a most productive sort in England.

Fenman is also one of Professor Biffen's recent productions, and the remarks upon Yeoman equally apply to this. It is even later than Yeoman, for it came into head seven weeks later than Hard Federation, the grain being extremely pinched and light.

Barleys.—O.A.C. 21 is of about the same season as Skinless, but it stools rather less and has tall straw, which is strong for a barley. The ear is bearded and of the six-row type; the grain is of a greenish tinge and well filled. It succeeds under irrigation, and should be a good barley for early fodder. Having a rather brittle neck or top internode, the crop should not be left to strip when quite ripe. as many heads will snap off. If possible, the crop should be cut and threshed when wanted for grain. For fodder and silage Skinless barley appears to yield about as well, but the O.A.C. 21 is well worth further trial.

The Second Commonwealth Census.

The second census of the Commonwealth of Australia will be taken as at midnight between Sunday, 3rd April, and Monday, 4th April. So momentous have been the events of the last decade; so great their effect upon population; and so extensive the changes in industrial and social conditions, that special interest may properly be felt in the event. A similar undertaking will engage the inhabitants of practically all parts of the British Empire at about the same time, and it may justly be said that it is a great Imperial stock-taking that is approaching. Were it a mere counting of heads it would be a matter of importance, but Mr. G. H. Knibbs, Commonwealth Statistician, in a little brochure on the subject, points out that it is a good deal more than that. The results, in fact, are of such significance nationally and socially, that it is of first importance that the information supplied should be accurate. The appeal is therefore made by the Federal authorities that care should be exercised in filling in the forms, and that no person should be omitted nor any question inaccurately answered.

Farmers' Experiment Plots.

WINTER FODDER VARIETY TRIALS, 1919–20.

Upper North Coast District.

W. D. KERLE, Inspector of Agriculture.

RESULTS of experiments with winter fodder crops sown during 1920 are available from the following nine centres in the Upper North Coast district:—

F. G. Gibbin, Burrapine, Nambucca River.
Henry Short, Dorrigo.
E. Green, The Risk, Kyogle, Richmond River.
G. Long, Tatham, Richmond River.
C. Oliver, Yorklea, Richmond River.
M. J. Reedy, Warrell Creek, Nambucca River.
E. Amps, Camira Creek, Grafton.
Mrs. F. T. Johnson, Condong, Tweed River.
F. Allard, Brooklana, Eastern Dorrigo.

Season and Cultural Methods.

The yields were most satisfactory and well above the average, but the season was an ideal one, particularly for late-sown plots. The extremely dry conditions of 1919 gave place to those of the other extreme in January of 1920, and heavy falls of rain were experienced each month up to November. The chief difficulty lay in sowing the crops, the dry intervals in autumn being short and infrequent. The early spring rains were unusually heavy, and were largely responsible for the yields being above normal.

The following table shows the rainfall for each centre during the chief months of growth:—

1920.	Burrapine.	Dorrigo.	The Risk, Kyogle.	Tatham.	Yorklea.	Warrell Creek.	Camira Creek.	Condong.	Brooklana.
	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.
March	...	...	...	49	...	...	...	...	...
April	..	...	267	258	...	...	...	279	...
May	...	...	427	498	...	...	...	554	...
June	134	192	159	225	210	148	226	374	...
July	401	634	435	435	440	431	382	952	...
August	24	41	92	80	91	57	142	160	51
September	257	502	...	...	301	348	258	...	534
October	503	671	...	...	320	308	290	...	520
November	...	...	...	...	...	...	...	...	562
Total inches	13·19	20·40	13·80	15·45	13·62	12·92	12·98	23·19	16.67

The yields obtained from the various fodder crops are shown in Table A. Trials with artificial fertilisers at six of the above centres are tabulated in Table B.

The amounts of seed sown per acre were:—Wheat, oats, and barley, 2 bushels; when sown with field peas, 1½ bushels; peas, ½ bushel. The most satisfactory amount of cereal per acre to sow with field peas as a combination crop is a matter of much controversy among farmers. In order to throw some light on the subject a trial was made on the property of Mr. M. J. Reedy, Warrell Creek, which resulted as follows:—

		tons	cwt.	qrs.	lb.
Thew wheat, 2 bushels and grey peas ½-bushel	=	6	10	2	11
„ 1½-bushels and grey peas ½-bushel	=	6	13	1	23
„ 1 bushel and grey peas ½-bushel	=	7	17	2	21

It will thus be seen that the higher the quantity of wheat applied the lower the yield, due, no doubt, to the peas having more room and making more luxuriant growth. The soil on which the experiment was sown was not very fertile and the yields for this crop were low. Further trials of this nature will be made here and at other centres to determine conclusively the most suitable amounts to apply.

The Plots.

Burrapine.—Soil, sandy alluvial loam; previous crop, maize; germination, excellent; soil preparation, thorough. The season being particularly favorable in this locality, the yields were exceptionally high. The plot of Hard

Plot of Sunrise Oats at Brooklana, Eastern Dorrigo.
The yield was 12 tons 6 cwt. 2 qrs.

Federation and grey peas, which occupied pride of place with nearly 19 tons to the acre, presented a particularly fine appearance, but only slightly better than the plots of Firbank and Thew with grey peas. The success of the plots in these experiments was largely due to the absence this year of rust, the bugbear of the coastal wheat-grower. This disease was present, but only slightly, Hard Federation, Yandilla King, and Canberra wheats, and Sunrise

and Guyra oats being affected. Although Hard Federation has done so well, it must be remembered that it is subject to rust, and should not be sown in place of Thew or Firbank, which (although occupying second and third places this season) are comparatively rust-resistant, and will give better results over a number of years.

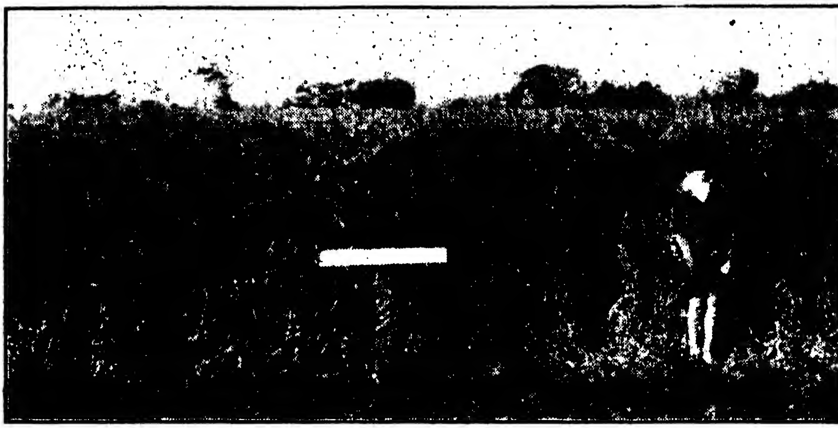
Dorrigo.—Soil, red volcanic, free working; previous crop, potatoes; sown 21st June, 1920. The chief feature of the experiments in this locality was the superiority of the oats in comparison with the wheats. This was largely due to the wheats being patchy, owing to infertile patches in the soil. The highest yield of oats was obtained with Guyra, which gave an approximate increase of a ton over Sunrise and Ruakura, and 2 tons over Algerian. It is, however, much coarser in the stem and not nearly so suitable for chaff as the other varieties, Ruakura in particular. The increase in the growth of Algerian oats with the addition of artificial fertiliser was remarkable, 2 cwt. of P7 mixture giving a yield of 13 tons 15 cwt. 3 qrs., and an increase of almost 6 tons over the unmanured plot. All other fertilisers gave substantial increases, the smallest (1 cwt. of superphosphate per acre), giving an increase of 2 tons 15 cwt. 2 qrs. 22 lb.

Firbank Wheat at Tatham.
Yield: 8 tons 0 cwt. 2 qrs. 16 lb.

Kyogle.—Soil, alluvial loam; previous crop, wheat; soil preparation, two ploughings and three harrowings; germination, excellent. The results from this centre were very satisfactory, the success of Algerian oats being most marked. The combination crops yielded remarkably well, with the exception of Firbank and Canada peas, the peas growing remarkably well until cut off by frost in July. The effect of frost was most marked in Bomen and Florence wheat and Skinless barley, but, despite the adverse influences, the last-mentioned gave a very excellent yield. Hard Federation proved the highest yielding wheat, rust being entirely absent this season.

Tatham.—Soil, alluvial loam; previous crop, maize; germination and stooling, satisfactory; tilth, excellent. The experiments here were sown early (19th March); the growth was rapid, and the yields very satisfactory. The plots of Thew with field peas and vetches looked particularly well

during growth, and eventually yielded well. Either of these legumes can be recommended for growing with Thew and other rust-resistant midseason wheats for the production of feed for dairy stock. Canada field peas are too early in maturing and do not make nearly such luxuriant growth as grey



Sunrise Oats at Tatham.
Yield : 11 tons 5 cwt. 3 qrs. 26 lb.

peas. Rust was bad on Hard Federation (which otherwise was the most uniform of all plots) and slight on Marshall's No. 3, all other varieties being practically free. Frost was severe on Bomen wheat and Guyra oats, the heads being severely damaged.

Thew Wheat at Tatham.
Yield : 7 tons 18 cwt. 1 qr. 11 lb.

Yorklea.—Soil, dark volcanic ridge, porous nature and medium fertility; previous crop, maize; preparation, once ploughed, twice harrowed; medium tilth; germination excellent. Ample rainfall favoured the oats in particular, and the plot of Sunrise was exceptionally fine for the locality. It eventually

yielded nearly 2½ tons per acre more than the next best plot. Hard Federation and grey peas was an excellent plot, and was fed chaffed to dairy stock, with an instant increase in the milk yield. Barley did not do at all well in comparison with other cereals.

Warrell Creek.—Soil, clay loam, medium fertility; previous crop, maize; stalks chaffed, and soil disc-ploughed, 24th May; disc and tine harrowed, 28th May, and seed broadcasted on 24th June; tilth very good, soil in moist condition; germination satisfactory; stooling poor. The growth of these plots rather poor and spindly, due, in a measure, to heavy rain causing the surface to set hard. The oat plots looked much superior to the wheats at harvest time, being fully a foot taller.

The increase with fertilisers was not so marked as the appearance of the soil seemed to warrant. It was, however, substantial, being 1 ton 3 cwt. in the case of 2 cwt. of P8 per acre among comparatively low yields. Yandilla King, with which the fertiliser trial was sown, is liable to rust and is short in the straw, and is, therefore, unsuitable for coastal conditions. Firbank grew to a height of 4 feet 6 inches, and appeared to be the best of the wheats in the matter of uniformity of growth and cleanness of straw, eventually yielding the highest.

Thew Wheat at Kyogle.
Yield: 6 tons 12 cwt. 1 qr. 21 lb.

The growth of field peas was very poor, Canada peas being practically non-existent where sown with Yandilla King, and grey peas being spindly and stunted. The failure of these legumes is most probably due to deficiency of lime in the soil, which is of a clayey nature and undoubtedly sour.

Camira Creek.—Soil, sandy, of poor quality; preparation, thorough; previous crop, maize; germination, satisfactory. The season favoured quick growth, and the yields were very good for such a poor class of soil. The increase due to fertiliser was nearly 100 per cent. Such increases are common with all crops in this locality. The yields of oats were very creditable,

Sunrise, the highest yielding variety, producing 10 tons 17 cwt. 0 qrs. 16 lb per acre. All varieties were manured with 2 cwt. of superphosphate per acre, the fertiliser being broadcasted previous to sowing the seed, and covered with two harrowings.

Condong.—Soil, alluvial, typical of Tweed river banks; previous crop, maize; preparation of soil and tilth, good. The germination of plots sown with new seed was excellent, but a number sown with seed held over from the previous season, through becoming infected with weevil, germinated too unevenly to enable accurate and comparative results to be procured. Ruakura oats, with a yield per acre of 10 tons 18 cwt. 2 qrs. 8 lb., made the best showing, and looked particularly pleasing during growth. This oat is very much liked by farmers for hay, owing to its fine stems and abundance of leaf. The results from the fertiliser trials here show that even on the alluvial soil of the Tweed a substantially increased crop may be obtained from the use of suitable manures.

Brooklana—Soil, yellow, basaltic formation, porous; previous crop, potatoes; preparation of soil, three ploughings and three harrowings; tilth good and germination excellent. The trials here were confined to three oat varieties and artificial fertilisers with Algerian oats. The sowing was made very late, but the elevation of the Eastern Dorrigo plateau being some 2,000 feet, suitable weather was experienced and the yields were very high for the district. The crop was converted into hay in December and will be utilised for the winter of 1921. Guyra yielded the highest, but a superior quality of hay was made from both Sunrise and Algerian. An increase of 2 tons 11 cwt. per acre was obtained from the use of fertiliser. While this is substantial, the increase is usually greater in this locality with all farm crops. It is, however, one that would doubly repay cost of the fertiliser applied even under the isolated position of the plateau, where the cost of haulage greatly adds to the expense.

Summary.

The chief features of the foregoing trials are the comparatively high yields of all cereals, the superiority of oats, and the success of varieties new to the district. With regard to the latter, Hard Federation, Yandilla King, Marshall's No. 3, and Canberra were sown largely to replace Huguenot, Cleveland, Warren, and Clarendon, all varieties of proven value in relation to rust-resistance and yield for coastal conditions, but seed of which was not obtainable last year. The good crops of Hard Federation, Yandilla King, Marshall's No. 3, and Canberra were due to the absence of rust this season. Had weather conditions favoured the spread of this disease the yields would have been decidedly reduced. Unless trials in succeeding years prove them to be more rust-resistant than they are generally believed to be, their adoption in place of such thoroughly tested varieties as Thew, Firbank, Huguenot, Florence, &c., is not recommended.

With regard to oats, Guyra has not been included to any extent in coastal trials in previous years. Although it out-yielded Algerian at five centres

Results of Winter Fodder Variety Trials.

	Burrapine.	Dorrigo.	Kyogle.	Tatham.	Yorklea.	Warrell Creek.	Camira Creek.	Condong.	Brooklana.
Date of Sowing, 1920.	22 May.	21 June.	2 April.	19 March.	21 May	4 June.	27 June.	15 April.	14 August.
Varieties and Mixtures	Yields per Acre.								
	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.
Hard Federation and Grey Peas	18 18 2 8	7 5 3 10	......	......	9 1 0 19	......	9 1 0 0	......	......
Firbank and Grey Peas	17 18 0 10	......	......	......	......	......	......	......	......
Bomen and Grey Peas	......	......	13 8 3 0	......	......	......	......	......	......
Thew and Grey Peas	17 7 0 0	9 3 2 15	12 10 0 0	14 2 0 11	......	......	......	*	......
Yandilla King and Grey Peas	......	......	......	......	......	6 0 3 13	......	......	......
Algerian Oats and Grey Peas	......	......	9 1 2 10	......	......	......	......	......	......
Marshall's No. 3 and Grey Peas	......	......	......	10 5 2 25	......	......	......	......	......
Hard Federation and Canada Peas	......	......	......	......	7 13 1 12	......	8 11 1 20	......	......
Firbank and Canada Peas	......	......	......	......	......	......	......	......	......
Ruakura Oats and Canada Peas	......	7 0 1 20	6 4 1 6	......	......	......	......	......	......
Thew and Canada Peas	......	7 4 2 0	......	......	......	......	......	......	......
Yandilla King and Canada Peas	......	......	......	8 7 0 14	......	4 12 1 8	......	......	......
Skinless Barley and Vetches	......	......	......	......	......	4 2 3 21	......	......	......
Thew and Vetches	......	......	......	13 6 1 20	......	......	......	......	......
Guyra Oats	14 2 3 12	9 17 0 0	13 1 1 24	9 6 1 10	10 14 2 0	6 2 3 10	10 0 0 0	......	13 15 0 0
Sunrise Oats	14 18 2 0	8 18 0 0	9 12 3 8	11 5 3 26	13 3 0 0	4 19 1 23	10 17 0 16	10 0 0 0	12 6 2 0
Algerian Oats	14 10 0 0	7 17 0 18	15 8 2 8	11 15 3 0	8 15 2 20	5 2 1 0	8 18 2 8	8 0 1 12	10 1 3 0
Ruakura Oats	......	8 15 0 0	......	......	......	......	......	10 18 2 8	......
Thew Wheat	11 7 0 8	6 7 2 12	6 12 1 21	7 18 1 11	7 12 0 26	5 2 0 19	6 10 1 0	8 15 3 0	......
Hard Federation Wheat	15 7 0 16	5 2 1 0	6 15 3 0	8 5 2 19	6 1 2 16	4 3 0 21	5 4 1 0	......	......
Firbank Wheat	10 18 2 8	6 2 1 14	6 8 3 18	8 0 2 16	6 15 2 25	6 8 3 1	6 4 3 12	*	......
Bomen Wheat	10 10 0 0	5 13 2 8	6 2 3 10	8 10 0 0	6 18 0 0	4 6 1 17	5 17 0 20	......	......
Florence Wheat	11 10 0 0	6 0 3 4	6 7 0 14	......	6 12 3 11	......	6 1 2 16	*	......
Yandilla King Wheat	10 15 2 0	5 14 0 0	5 12 2 0	......	7 0 3 22	5 15 0 24	4 19 3 0	......	......
Canberra Wheat	14 17 1 15	......	5 12 1 17	......	6 3 2 14	4 3 2 14	5 2 2 8	......	......
Cleveland Wheat	10 12 3 12	......	......	......	......	......	......	*	......
Marshall's No. 3 Wheat	......	......	......	7 10 0 0	......	5 13 1 10	......	......	......
Skinless Barley	13 0 0 0	5 0 3 8	7 3 0 0	......	5 2 1 21	......	4 11 2 12	......	......
Cape Barley	14 4 1 2	5 7 0 10	5 7 0 22	......	5 9 0 4	......	4 5 1 16	......	......

* Failed owing to use of weevily seed.

out of eight, its coarseness of straw and leaf, its leaf discolouration (which is most marked), and its susceptibility to rust makes it inferior for green feed, and particularly for hay.

The combination crops of cereal and legume most suitable for dairy stock, from the standpoint of milk production, are grey field peas or vetches, with Thew, Bomen, Firbank, and Hard Federation wheat. The combination of oats and peas has not been so successful, a comparison of grey peas with Algerian oats and with Thew wheat at Kyogle showing an increase of 3 tons 16 cwt. 1 qr. 14 lb. in favour of the latter.

With regard to the trials with artificial fertilisers, it is noteworthy that in all cases increases in yield were obtained. These increases ranged from 1 ton 2 cwt. 3 qrs. 12 lb. to 5 tons 18 cwt. 2 qrs. 10 lb., and represent a substantial margin over cost of application.

The results of these experiments generally, being more or less consistent with previous trials, form a valuable index to suitable winter and early spring fodders for local farmers. It is surprising that so many dairy farmers rely solely on their pastures, knowing full well they must be inadequate at some period of the year. A frequent excuse for not growing cereals is that they have been tried, but without success. Failures can usually be traced, however, to inferior seed and an ignorance of suitable varieties. Farmers are too apt to visit the nearest store and take whatever wheat is in stock (even chick-wheat), instead of taking advantage of experiments such as these (conducted solely for their guidance), and ordering suitable varieties from reliable sources.

RESULTS of fertiliser trials.

	Dorrigo.	Brooklana.	Warrell Ck.	Camira Ck.	Yorklea.	Condong.
	Algerian Oats.	Algerian Oats.	Yandilla King Wheat.	Thew Wheat.	Thew Wheat.	Algerian Oats.
Date of Sowing	21 June.	14 August.	4 June.	27 June.	21 May.	15 April.
Fertiliser per acre.	Yields per acre.					
	t. c. q. lb.	t. c. q. lb	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.
* 2 cwt. P7	13 15 3 0	12 0 1 0	6 17 0 11	6 14 2 0	6 11 2 10	10 8 0 0
2 cwt. superphosphate ..	13 5 2 0	12 12 3 12	6 11 1 20	6 10 1 0	8 1 0 12	10 5 3 0
* 1½ cwt. M5	13 1 1 20	....	6 18 2 8	5 14 0 0	7 3 0 0	9 17 2 10
* 2 cwt P8..	13 1 0 16	11 2 0 16	6 17 1 0	6 2 3 10	7 8 2 22	10 11 1 0
1 cwt. superphosphate ..	10 12 3 12	10 14 2 0	6 5 3 24	....	6 10 1 18	....
No manure..	7 17 0 18	10 1 3 0	5 15 2 24	3 15 0 0	6 0 1 20	8 0 1 12
Greatest increase due to fertiliser	5 18 2 10	2 11 0 12	1 2 3 12	2 19 2 0	2 0 2 20	2 10 3 16

* P7 consists of equal parts superphosphate and bonedust; M5 of superphosphate two parts and sulphate of ammonia one part; and P8 of equal parts superphosphate and blood and bone.

I BELIEVE that co-operative organisation is the best, and perhaps the only way of teaching the small farmer business method and the power of combined effort, and that until this lesson is learned, lectures on increased production are largely waste of time and money.—LIONEL SMITH-GORDON in *Better Business.*

The Culture of Sugar Cane in New South Wales.

[Continued from page 32.]

A. H. HAYWOOD, Manager, Wollongbar Experiment Farm.

The Question of Varieties.

As remarked at the beginning of this series of articles, the Government Statistician's figures indicate that—notwithstanding the lament over good sugar-canes dropped by growers in years gone by—there has lately been a distinct improvement in the average sugar content of the cane grown on our rivers. In a large measure, no doubt, that improvement has been unconscious so far as growers are concerned, the varieties introduced to take the place of those that have had to be discarded being generally the result of cross-breeding and selection carried on elsewhere. The facts, however, do indicate the excellent possibilities offered by systematic work in that direction. How important sugar-content is as a factor in profitable production hardly needs to be pointed out, but it is perhaps worth while remarking that whereas 8 per cent. of sucrose means 110 lb. of sugar per ton of cane, 14·4 per cent. of sucrose means 175 lb.

The importance of plant improvement, in relation to sugar-cane, is so fully recognised in Louisiana—where the production of sugar is perhaps as large as anywhere in the world—that cross-breeding and improvement by selection goes on as a regular feature year after year. Results encouraging as to both total yield and sugar-content have been obtained, and the work is now on an extensive scale. In one year, it is recorded, at least 1,805 varieties were under test—many of them being worthless, of course, but a few being promising. Cane growers in Louisiana are much interested in the work, and already varieties have been produced that are expected to put a very different aspect on the industry there.

At the same time, there has been, and perhaps still is in Australia, a disposition to regard new varieties as so many talismans for the solution of all cane-growers' troubles. The notion is obviously unsound. What is wanted is the best variety for the conditions, quite apart from whether it is new or old, and at the same time the consistent selection of seed from vigorous and disease-free plants. That there is a good deal to be known on this subject of varieties is apparent from the statement lately made by a well-informed man that at the present time some fifty or sixty varieties are being grown on our rivers. Having regard to the fact that soil and climatic conditions under which sugar cane is grown in New South Wales might roughly be divided into say half-a-dozen groups, in respect of each of

which perhaps, one or two varieties could be named as most suitable, it would appear that less than a dozen varieties would be ample for all ordinary requirements.

It is not so much new varieties that are needed as an ampler knowledge of the comparative usefulness of existing varieties, together with systematic testing of any others that seem likely to be useful here.

Some indication of the possibilities of improvement of the varieties grown in this State, when subjected to systematic observation and selection, is afforded by a few stools that are growing at the Department's Duck Creek farm on the Richmond River. A year or two ago attention was directed to a root of sugar cane growing on certain land, which, neglected for some years, had become overrun with lantana. That a root should survive under such adverse conditions seemed to argue a vigour that might be desirable in a cultivated crop, and a few canes were saved. From them the stools at Duck Creek farm were raised. What the sugar-content may be has yet to be learned, of course, but 8 feet of cutting cane of great thickness and a good stooling habit suggest that the strain may prove a useful one. It may be that by some such accident a distinct advance may some day be made.

Systematic crossing, of course, can only be carried on where the cane will "arrow" or run to seed, but it may be that by introducing from other countries seedlings regarded as promising for our conditions, and acclimatising and selecting them here, improved strains of much significance to the industry may be produced. The task is one that, far from being uninteresting or unattractive, opens up possibilities that might well engage a few progressive farmers.

The following brief notes about the varieties best known on our northern rivers are intended to indicate as far as possible the utility of each.

New Guinea No. 16.—This is the variety that is perhaps most extensively grown in New South Wales. It occupies nearly 80 per cent. of the area on the Clarence, is second in favour with growers on the Richmond, and is also sown on a fair area on the Tweed.

It is a purple cane, fairly erect, and of leafy habit, throwing a lot of flag, which tends to keep down weeds ; not a high-testing cane, but a good cropper, standing dry weather well and responding at once to rain ; a slow grower the first year, and therefore properly a two-year cane ; "arrows" in certain years on the Tweed. In at least one case in the past season the yield was estimated at 70 tons per acre. New Guinea No. 16 cannot be recommended for rich land on account of its rank growth and poor quality, but it is specially adapted to light and medium soils, and to land that has been under cultivation for a number of years.

Badila.—On the Clarence one-tenth of the area under cane is planted with this variety ; on the tweed it is largely grown on account of its preference for wet conditions, and on the Richmond it also has many partisans, being specially adapted for new rich land and for well cultivated land of good

quality. Notwithstanding its somewhat delicate character and its liking for moisture, it crops well in a dry season, and at all times responds well to good cultivation methods. Being of a spreading and leafy habit, it is a good frost-resister. The sugar-content of the cane is high, and the yields at times as much as 40 and 50 tons per acre ; during the past season at least one crop of approximately 70 tons per acre was found.

Mahona.—This variety was at one time very popular, but latterly it has been attacked by fungus pests, and the area under it is now much smaller than in years gone by. It seems particularly liable to leaf scald, a disease that has lately made its appearance on the Richmond, and that in some instances has wiped out whole crops. There are plenty of healthy crops of Mahona yet, however, on the Richmond, and it is quite possible to save it if good methods are adopted and if diseased crops are avoided for seeding purposes. It occupies 40 to 50 per cent. of the cane-lands on that river, being highly adapted to the heavy land between the river and the sea. Apart from its liability to disease, its greatest faults are its soft skin (which makes it liable to the attacks of rats), and a disposition for a percentage of the canes to lodge and to be snapped off when the ground is being cultivated. It is a quick grower and most likely of all to provide a crop at one year, and it is useful as a good cow cane.

Malabar.—This is an old time favorite that has long ago been given up on the Clarence, but that does particularly well on indifferently drained areas on the Richmond. It is a very erect, strong grower, with a strong broad leaf that affords plenty of protection to the cane, and it is generally so vigorous in habit as to escape many of the troubles of other canes. At least one crop estimated to run 80 tons to the acre was last season to be seen on the Richmond. Gumming, so generally associated with want of drainage, does not seem to affect Malabar to the same extent as some other varieties, but in sugar-content it is rather weak, especially if not allowed to mature fully. Its vigorous habit makes it somewhat of a favourite on the stony lands of the Cudgen area, but growers should take care that they plant only from sound stock. Drill planting is preferable with Malabar, and sets are generally dropped 2 feet apart in the row.

Innis 131.—This variety is grown to a limited extent on the Clarence, while an occasional crop may be seen on the Richmond. It is a very erect grower and a poor stooler, and hence should be planted in drills. For sandy ground it is, perhaps, the best of all varieties at present grown in New South Wales, and it has the recommendations that it weighs well at the mill and is rich in sugar, but for the most part there are more profitable sorts.

D 1135.—At one time this variety was extensively grown, but it became susceptible to Fiji and other diseases, and only a few crops of it are now to be seen. It is fairly well suited to the poorer classes of soils, and under conditions favourable to it, matures rapidly ; but where it has been growing for a number of years the introduction of one of the newer canes might be said to be imperative.

1900 *Seedling.*—This is a cane of high quality that yields some good crops on well-drained lands, but it is very susceptible to Fiji disease, and, consequently, the sets should be carefully selected.

No. 14.—This is still regarded by farmers as one of the best canes ever grown on the rivers, but it became badly affected with Fiji and other diseases some years ago, and has been dropped. It is only mentioned here as a variety that might be well worth attention in plant improvement work, a direction in which opportunities do present themselves to observant farmers.

Louisiana 511.—Coming first into prominence in the country of its origin in 1908, Louisiana 511 has since maintained a reputation for high sugar-content. It is tall and erect in habit, and has been observed at Coimbatore sugar-cane breeding station in India to carry an extremely short top—an indication of early maturity. It is under trial at the Department's Duck Creek farm, and has been found to produce as much as 6 feet of cutting cane. In common with one or two other varieties which have been produced in Louisiana, this cane is regarded as beginning a new era in the production of sugar. It is one of the conspicuous examples of the possibilities that systematic plant improvement offers, and is in itself an encouragement to someone to take up the matter in this country.

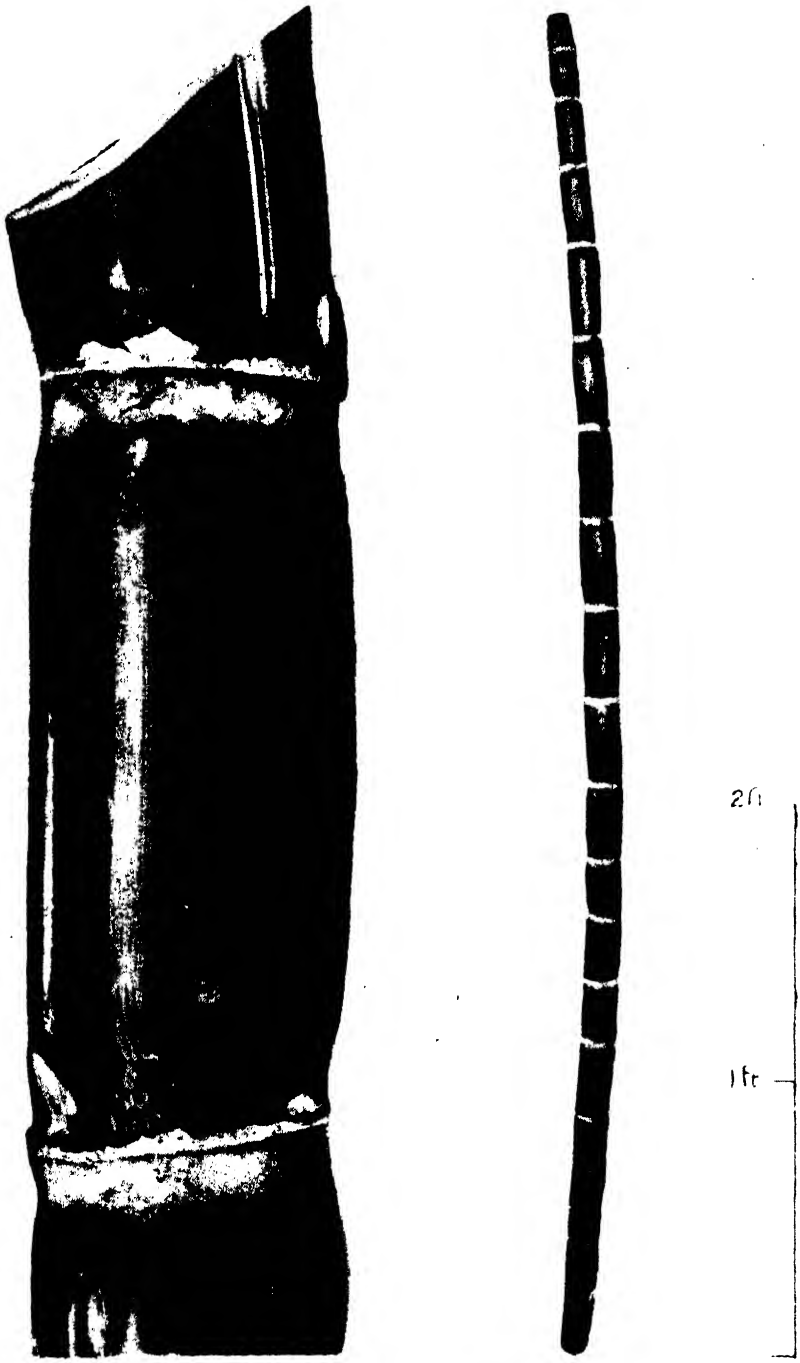
D 75.—This is another new variety from Louisiana; it carries a very large green cane, and it is reputed to be profitable for its sugar-content. It is also under trial at Duck Creek farm, where its behaviour is being watched with interest.

(*To be continued*).

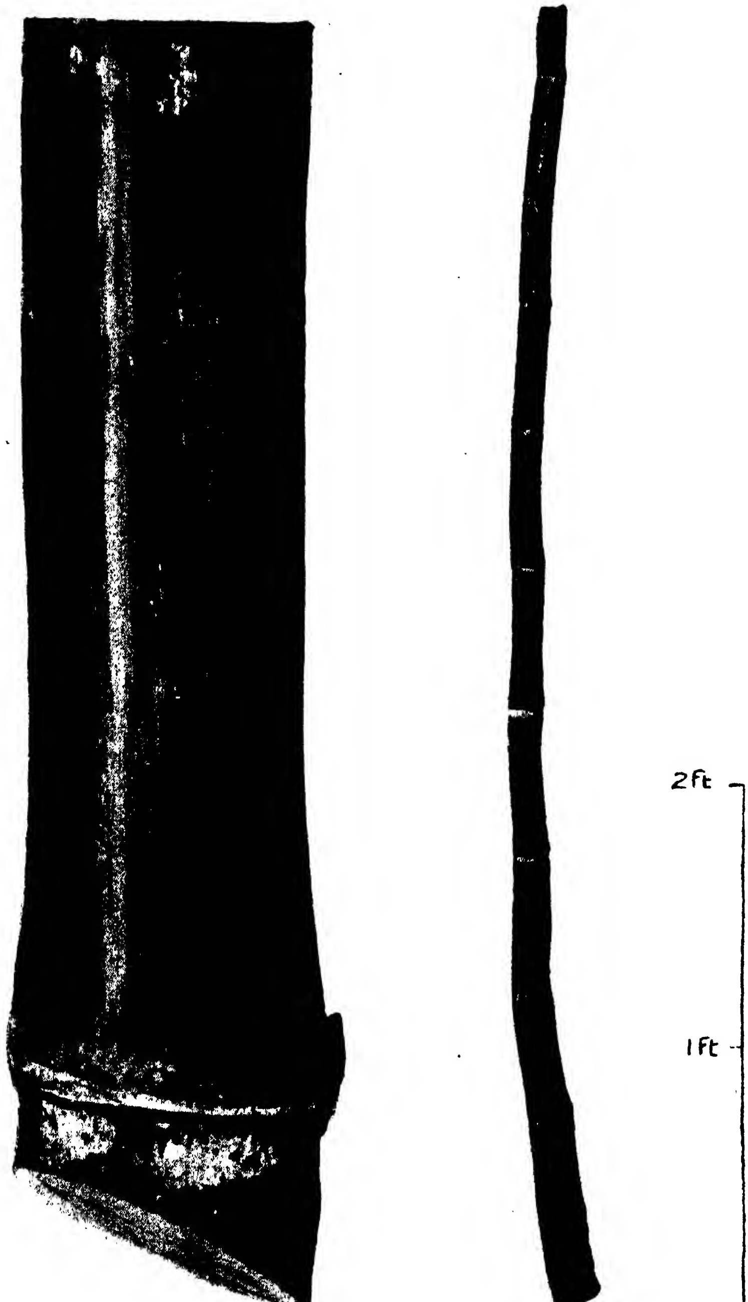
Gallipoli Wheat under Local Conditions.

Through the courtesy of the Victorian Department of Agriculture, a sample of Gallipoli Wheat—a variety from which good results have been obtained in the southern State—were recently received by the New South Wales Department from Werribee Research Farm for local trial. The seed was sown at this farm on 13th May, 1920, at the rate of 50 lb. seed with 56 lb. superphosphate per acre. It proved to be a late-maturing variety, with short straw and brown, erect, club-shaped ear, holding its grain very firmly—it is, in fact, extremely tough to strip. From the several heads differing in type from those of the body of the crop, it was judged that the variety was not yet properly fixed; these heads were removed prior to harvesting. The yield was 26 bushels per acre. The following yields were obtained from other varieties in the same trial grown under similar conditions: Major, 28 bushels; Yandilla King, 27 bushels 37 lb.; Federation, 27 bushels 21b.; Hard Federation, 25 bushels 17 lb.; Marshall's No. 3, 25 bushels; Wagga 47, 24 bushels; Currawa, 23 bushels 54 lb.; Canberra, 23 bushels 31 lb.; Wilfred, 22 bushels 19 lb.; Zealand, 19 bushels 22 lb.; Hamel, 19 bushels 10 lb.; Bomen, 18 bushels.

All varieties suffered reduction in yield as the result of lodging and shedding, but Gallipoli suffered least in this respect, owing to its short, strong straw, and to the firmness with which it holds its grain.—H. C. Stening, Manager, Temora Experiment Farm.

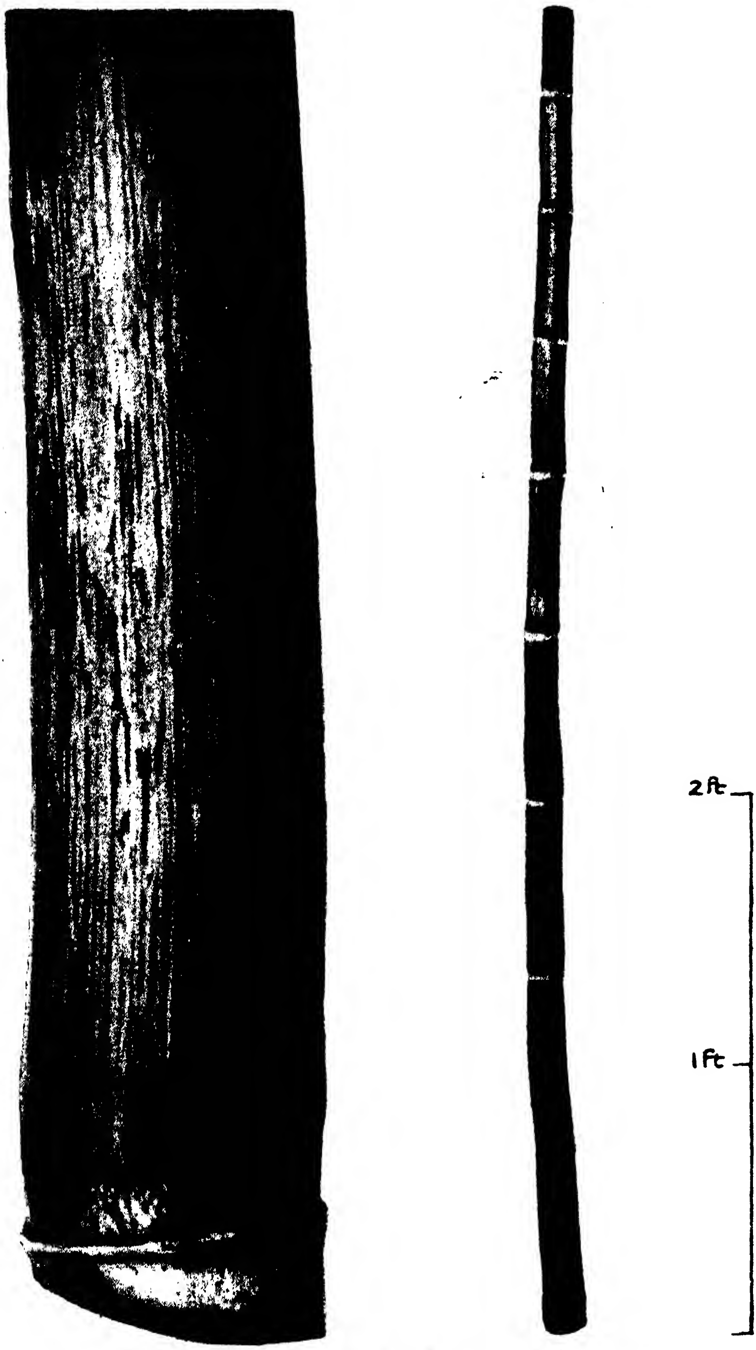


New Guinea No. 16 Sugar Cane.
One node, natural size, on the left.



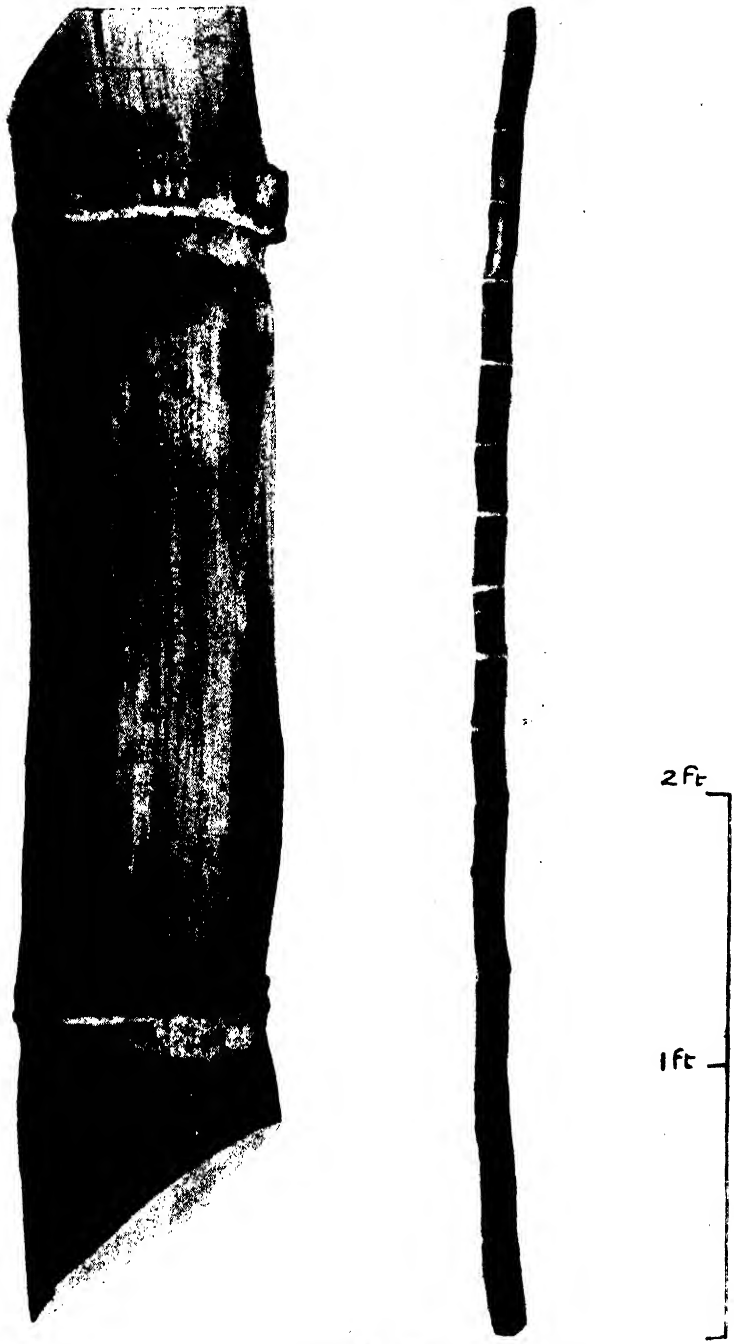
Mahona Sugar Cane

One node was photographed natural size, but it was so large that the whole could not be reproduced on the page.



Malabar Sugar Cane.

One node was photographed natural size, but was so large that the whole could not be reproduced on the page.



D 1135 Sugar Cane.
One node, natural size, on the left.

The R.A.S. Field Wheat Competition.

[In 1920 the Royal Agricultural Society, for the third time, promoted a Field Wheat Competition, and, with the approval of the Minister for Agriculture, Mr. W. R. Birks, B.Sc. (Agric.), Inspector of Agriculture, acted as judge. The following extracts from the report furnished to the President and Council of the Society by Mr. Birks will be found of interest to all wheat-growers.]

THE district covered by the present competition embraces that part of the main wheat belt bounded on the south approximately by the line Blayney-Condobolin, and on the north by the line Coolah-Coonamble. All the important wheat-growing centres of this area were represented in the original entries, which numbered fifty-four. Of these twenty-four were voluntarily withdrawn prior to the judging tour, leaving thirty fields, which were ultimately inspected during the latter half of November.

In so bountiful a season as the present, heavy crops are to be expected as the general rule. Most of the fields inspected, however, made an exceptionally fine showing, and none can be said to be anything less than a very good crop.

Under the prescribed system of judging, consideration is paid not only to yielding capacity, but, possibly to an even greater extent, to the relative suitability of the crop for seed purposes. In framing the award, strict account has been taken of this aspect of the competition.

The Season.

Taking the district as a whole, the main feature of the season may be described thus: An exceptionally dry fallowing period (July 1919, to March, 1920), followed by a practically rainless autumn. Thus, in the majority of cases, the seed was sown in dry ground, worked up in most unfavourable circumstances, and, at the end of May, the prospect for this year's crop, both as to yield and cleanliness, was by no means bright. The break of the drought in the early days of June was, of course, general, and the monthly rainfall for the winter and early spring may be given roughly, on the average, as follows :—June, 6 inches; July, 5 inches; August, 2 inches; September, 3 inches. October was comparatively dry, less than an inch being recorded in most localities, but the growing season was rounded off by two most opportune falls in November—approximately ¾ of an inch in the first week, and ½ an inch about the middle of the month.

Under these circumstances, thorough fallowing and careful preparation of the seed-bed cannot be expected to show the marked results obtained in normal seasons, and little relative importance can be attached to the cultivation methods employed in individual cases. However, it is of interest to note that of the farms visited those on which modern methods have been followed for a period of years on a definite system show prospects of an ample reward in the form of freedom from weeds and disease.

District Distinctions.

The normal relative district yields are also varied in a season such as this. The easterly portions of the area, usually more favoured, have, if anything, suffered from a certain amount of rankness of growth and a prevalence of weeds and rubbish, while towards the western limits of the wheat-growing country (that is, westward of the line Trundle–Peak Hill–Narromine), the crops, for the most part, seem cleaner; they stand up well on comparatively short straw, and show prospect of uniformly heavy yields.

Soils.

Further, different types of soils show exceptional results. Of the heaviest half-dozen crops inspected two were grown on semi-alluvial riverside country, one on red basaltic soil, and one on country tending towards the black-soil plain type. That is to say, the soils which are, normally, to be expected to give flaggy growth liable to burn off in spring, this year carry very fine crops of grain. For the rest, almost every type of good wheat-growing soil to be found in the west was represented, varying from sandy loam to hard red clay, and embracing typical box and pine country, with an odd sprinkling of buddah, belah, and ironbark.

Varieties.

The only generalisation which can be made from the results is that, on the whole, Federation still takes pride of place on the western slopes, while on the broader, earlier areas of the plains, Hard Federation is favourite, and promises the heaviest yields.

A striking feature of the entries is the enterprise they display on the part of the competitors in the introduction and trial of new varieties. In addition to the standard New South Wales sorts, many of the principal Victorian, South Australian and Western Australian varieties were met with. Of greater interest still are the cases of wheats evolved within the district. Thus Redwing is a wheat selected by Mr. D. A. Rich, of Wellington, while something of a climax is reached in the case of Plowman's No. 3, a wheat produced by the exhibitor on his own farm.

Apart from the competition, it is to be noted that attention is not confined to Australian varieties. Several cases of foreign importations were seen, notably a small-plot of an Egyptian wheat raised from a sample forwarded by the grower's son while on active service. Further, in individual cases, the practices of actual cross-breeding, hand-selection, and hand-picking of fairly large areas were all seen in operation.

The district is fortunate in having a number of prominent growers who are very much alive to the possibilities of careful selection for the maintenance of the high standard of established varieties, together with the evolution of new types especially adapted to local conditions. And it is to be remarked that these gentlemen bring very considerable plant-breeding skill and efficiency to their task.

Seed and Manure.

Little can be said as to the rates of seeding. They are normal in their respective districts, except where slightly affected by the almost universal financial stringency of the period.

The apparent unpopularity of artificial fertiliser is a striking feature of the entries. The restriction of the use of superphosphate is also due in part to considerations of economy. On the other hand, the district includes a wide area in which superphosphate is of doubtful or negative value in wheat-growing. Thus, in the country lying west and north of Dubbo (*e.g.*, Narromine and Gilgandra), the normal practice is to sow without manure.

However, in other localities, such as Parkes, Wellington, and especially the higher country between Mudgee and Coonabarabran, the more liberal use of superphosphate would probably have shown a handsome profit.

Trueness to Type and Purity.

The presence of "strangers" was the cause of loss of points in many cases. The fault arises not only from mixed seed, but also, and especially in a season such as this, from sowing on stubble ground which last year carried a a different variety of wheat. In preventing the actual mixing of seed, too, greater care than is usually exercised is necessary in the thorough cleaning of both harvesting and drilling machinery. The raising of seed from periodically hand-selected samples is also essential to maintain the standard and purity of a type. Several striking illustrations of this point were observed. Thus such popular varieties as Purple Straw and Gluyas, for which no source of selected seed exists locally, are generally found to be very badly mixed, whereas the crops raised from seed distributed by the Government farms are often remarkably pure. Again, the history of the improvement of Hard Federation is recalled in the slight variations of type met with in the entries of this variety. The original distribution of this wheat prior to 1915 was of seed raised by Mr. Pridham from his early selections. The variety then showed both brown and whitish heads, and this mixed type is still to be met with. Since then, Mr. Pridham has succeeded in isolating and fixing the pure brown strain, which he selected as the genuine type. This rich brown colour is easily distinguishable from the lighter hue of crops of the original type, and where it occurred in the competition, the entry naturally scored better for "trueness to type" than those showing the characters of the older and now obsolete variation.

Disease.

All the commoner local diseases of wheat were met with in a greater or lesser degree of prevalence. Rust had everywhere established itself in the more susceptible varieties, but, thanks to the dry spell in October, little damage is to be anticipated.

Flag smut was seen in several of the competing crops, but only on odd, scattered plants. In neighbouring paddocks, however, several examples of serious outbreaks of this disease were noticed, and in some cases as much as 30 to 50 per cent. loss was indicated.

Twenty-five per cent. of the entries were affected by take-all, and in two at least the loss caused was serious, being in the region of 15 to 20 per cent. In every case the land had suffered from continuous cropping to wheat for a number of years at some time in its history. And from land where such mismanagement had allowed the disease to establish itself, it appeared that neither one year's fallow, nor even a year's grazing followed by a winter fallow, was sufficient to eradicate the evil. The evidence gathered on this point bears out the established idea that the only sure combative method consists of periodic fallowing, and the avoidance of more than two crops at most in succession, of which the second should be oats.

Bunt or ball-smut was by far the most serious disease met with, and it is responsible for more or less heavy deductions under the heading "freedom from disease" in thirteen cases. It is difficult to explain the occurrence of this disease in every case. No doubt the necessity of dry sowing induced some growers to forego pickling, and the absence of summer and autumn rains would leave last year's bunt spores intact, to germinate along with the seed when rain ultimately fell. But in some cases, pickled seed sown on fallow still gave a bunt-infested crop. Nevertheless, on those farms on which the land is periodically cleaned by grazing and fallowing, and where nothing but clean, well-pickled seed has been sown for many years, the crops were singularly free from this and other diseases.

Weeds.

Careless farming, either recently or in years gone by, is reflected in an abundance of black oats in the wheat this year. Three competitors suffered heavily on this score, and the presence of oats was, no doubt, the deciding factor in many of the withdrawals.

That this pest can be definitely controlled is demonstrated by the presence of perfectly clean crops on old cultivation ground in badly infected areas. Some of the factors contributing to success in this direction have already been referred to in the foregoing paragraph. In addition, a light dressing of superphosphate is claimed by some competitors to give their wheat an advantage over the ubiquitous oat. Not the least important precaution, however, is shallow seeding. Many of the black oat and other weed seeds lie upon or just beneath the surface of the ground, whereas the drill, especially in soft, dry ground, may put the wheat down to a depth of three inches or more if special precautions be not taken. The rubbish thus gains an advantage of anything up to a week or ten day's growth over the wheat, and that at a very critical period in the struggle for possession of the field.

Condition and Appearance.

Under this heading account is taken of such faults as lodging and tangling, flagginess, frosted or burnt tip, &c. However, none of the entries showed any of these defects to an appreciable extent. Several crops badly lodged were among those withdrawn.

Details of Awards.

Competitor's Name and Address. (In Order of Merit.)	Age of Field.	Present Crop Sown on	Date of Seeding.	Amount of Seed.	Amount of Manure (super.)	Variety.	Trueness to Type and Purity. Max. 20.	Freedom from Disease. 20.	Evenness. 20.	Cleanliness. 30*	Condition and Appearance. 28†	Apparent Yield. ‡	Total Points
	Field Particulars.			lb.			Points Awarded.						
1. Thos. Bragg, Mungeribar	5th Crop	Summer fallow	6 May	45	Nil.	Hard Federation	17	19	20	27	26	39	148
2. Messrs. Martin Bros., "Bodangora," Wellington.	14th ,,	Wheat stubble	3 June	45	,,	Imp. Steinwedel	15	17	19	29	28	37	145
3. H. K. Nock, "Nelungaloo," Parkes.	8th ,,	Winter fallow	5 May	45	30 lb.	Federation Onas	17	18	17	28	26	38	144
4. W. B. Oates, "Rosewich," Narromine.	20th ,,	Old cultivation land	15 ,,	30	Nil.	Hard Federation	17	13	19	28	27	38	142
4. A. Pagan, "Mentone," Gilgandra.	5th ,,	Wheat stubble	15 ,,	40	,,	Federation	17	19	17	27	22	40	142
6. J. W. Eade, Euchareena	10th ,,	,, ,,	10 June	40	,,	Federation	19	11	19	25	28	39	141
7. Thos. Auld, Cainbill Creek, Leadville.	6th ,,	,, ,,	6 May	37	,,	Cleveland, Currawa	17	16	17	28	23	39	140
7. J. J. McIntyre, "Peak Downs," Peak Hill.	1st ,,	Summer fallow	6 ,,	42	,,	Hard Federation	17	19	19	23	23	39	140
9. A. Richards, "Goodwill," Everton, Gilgandra.	5th ,,	Wheat stubble	20 ,,	36	,,	Hard Federation, Redwing.	16	11	20	27	23	42	139
10. E. A. Draper, "Harris Park," Alectown.	7th ,,	Winter fallow	15 ,,	42	28 lb.	Bomen, Canberra, Imp. Steinwedel.	16	11	20	28	25	37	137
10. A. M. Thomson, "Kurrajong Park," Trundle	6th ,,	Wheat stubble	14 ,,	45	40 ,,	Canberra	15	20	18	26	23	35	137
12. W. E. Tayler, Lloyd & Co., "Adavale," Parkes.	6th ,,	,, ,,	5 ,,	45	Nil.	Imp. Steinwedel, Viking	17	15	20	27	25	32	136
13. W. Dohnt, "Bonnie Doone," Eumungerie.	6th ,,	,, ,,	27 April	45	,,	Moira	18	11	19	28	26	33	135
13. S. Plowman, "Emu Vale," Parkes.	12th ,,	Old cultivation land	3 July	30	,,	Plowman's No. 3, Hard Federation.	17	18	19	24	26	21	135

* First Crop, 24; 2nd, 25; 3rd, 26; 4th, 27; 5th, 28; 6th, 29; over 6th, 30 points. † First or Second Crop, 24; 3rd or 4th, 25; 5th or 6th, 26; over 6th, 28 points.
‡ One point for each bushel of apparent yield.

Apparent Yield.

In a season so unusually unfavourable, even the oldest and most experienced growers hesitate to put a definite estimate upon their crops. It may eventually prove that discrepancies exist between the apparent yields as estimated and the actual harvest results, but whatever unavoidable error may have crept in here will be common to all cases, and the relative yields of competing crops are probably very closely represented by the scale of points allotted.

Conclusion.

The general impression left by the tour involved in judging the competition is one of greatly enhanced confidence in the possibilities and prospects of wheat-growing in the western district.

It is a significant fact that many of the best crops seen were raised from seed grown on the farms, the product of the crops varying from 6 to 12 bushels per acre, grown in the record drought of 1919. Some growers go so far as to claim that, given proper methods of cultivation, there has not yet been a drought severe enough to cause a total crop failure. Taking the district as a whole, it may, at least, confidently be asserted that when the the general standard of farming has reached the high level exemplified in the methods of some of the leading entrants in the present competition, our inevitable periodic droughts need not be expected to cause more than a fraction of the loss entailed in the disastrous experiences of recent years; and the industry will then stand upon a correspondingly sounder basis.

The thirteen crops to which trophies and certificates of commendation were awarded are given on page 189.

Influence of Milk Records on Prices of Cattle.

In recent years, milk recording in Scotland has had a remarkable effect on the prices of good milk record cows and their progeny at both public and private sales. Auction sales of young bulls and other milk record stock, at the instance of well-known breeders, have now become common, either at the farms of the owners or at special sales at market centres, when the milk records or the milking pedigrees of the animals are stated in the catalogue of sale. Something still depends on the appearance of the animal, but if in addition to good appearance there is a good milk record for the animal, or for the dam and grand-dams, the prices now obtained are almost fabulous compared with pre-record days. . . . . . .

In view of the great influence of official milk records on the commercial value of dairy animals in recent years, the general body of breeders in Scotland have concluded that the time has come when such record should be taken into account in the judging of dairy cattle at cattle shows. As a result of a mass meeting of breeders of dairy cattle and others interested, held in Ayr in the beginning of 1919, a new standard of judging Ayrshire cattle has been agreed to, whereby from 1921 a maximum of 35 points out of a total maximum of 100 points are to be reserved for allocation according to a definite scale for authenticated milk yields . . . . This is an event of pre-eminent importance, not only in the history of the Ayrshire breed, but in the history of milk recording in Scotland.—William Stevenson in the *Scottish Journal of Agriculture.*

Popular Descriptions of Grasses.

[Continued from Vol. XXXI, page 792.]

E. BREAKWELL, B.A., B.Sc., Agrostologist.

The Spear, or Corkscrew, and the Wire Grasses.

THE Spear, or Corkscrew, grasses (*Stipa sp.*) are so called on account of the characteristic shape of the seed, which is like a corkscrew or miniature spear, enabling it to bore into the flesh of animals, and sometimes to cause considerable injury. These grasses are often confused in the field with the Wire grasses (*Aristida sp.*); in the case of the latter, however, the bristle or awn of the seed is divided into three branches, while the Stipa seed has a single awn.

Spear or Corkscrew Grasses.—The Stipa grasses are common throughout the warmer portions of the globe; in this State they are as cosmopolitan as the Danthonia grasses, being found in all localities from the coast to the western borders. Generally speaking, they are confined to the southern temperate regions of Australia, being very rare or absent in Queensland and the Northern Territory. Danthonia and Stipa grasses grow well together, and this association forms the greatest part of the good sheep native pastures on the tablelands and slopes of the interior.

As the name implies, the Spear or Corkscrew grasses are readily distinguished by the shape of the seed. This is long, cylindrical, and very sharp-pointed in character, and often has a tuft of hair situated on the point. Attached to the seed is an awn or bristle, sometimes of considerable length, and spirally twisted like a corkscrew. This awn is considerably affected by variations in moisture. For example, if we assume that Stipa seeds are lying on the surface of the soil, and that the awns have become moist through dew or rain, then, when the air becomes dry and the moisture evaporates from the awn, a twisting action is set up in the latter, and the seed penetrates into the soil. It is this twisting action which also enables the seed to bore, in some cases, through the entire layer of skins of animals.

The commonest and most important Stipa grasses occurring in our native pastures are *S. setacea* and *S. scabra*. Miles of country in the western slopes and interior are covered with these, and they are often associated with Danthonia species. The principal features which render them valuable are as follow:—

1. The seed germinates very quickly after thunderstorms. Experiments carried out on the germination of these seeds in the seed-testing laboratory of the Botanic Gardens show that the sprout begins to show forty-eight hours after the seed is moistened, whereas with most grasses this does not take place for from five to seven days.

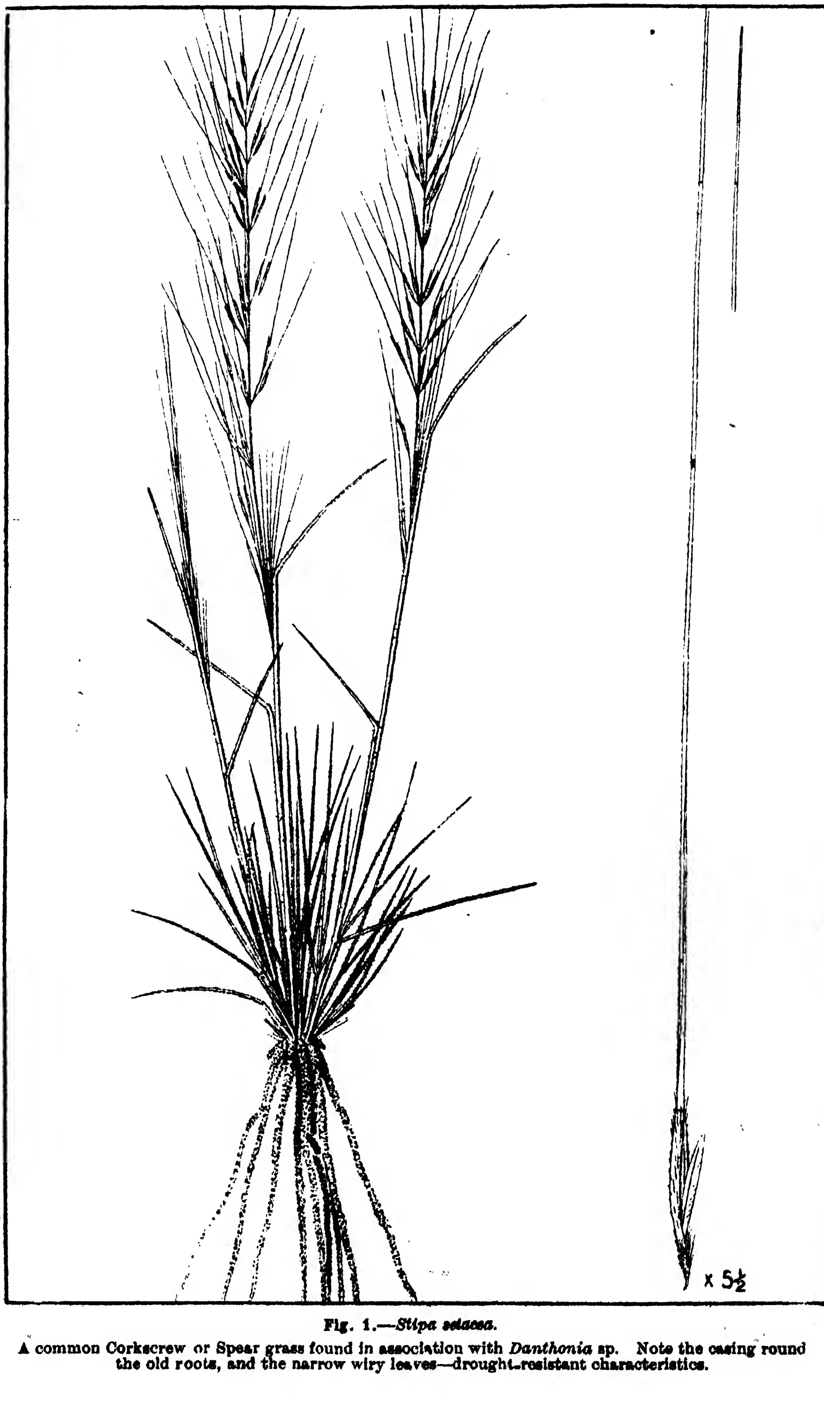


Fig. 1.—*Stipa setacea.*

A common Corkscrew or Spear grass found in association with *Danthonia* sp. Note the casing round the old roots, and the narrow wiry leaves—drought-resistant characteristics.

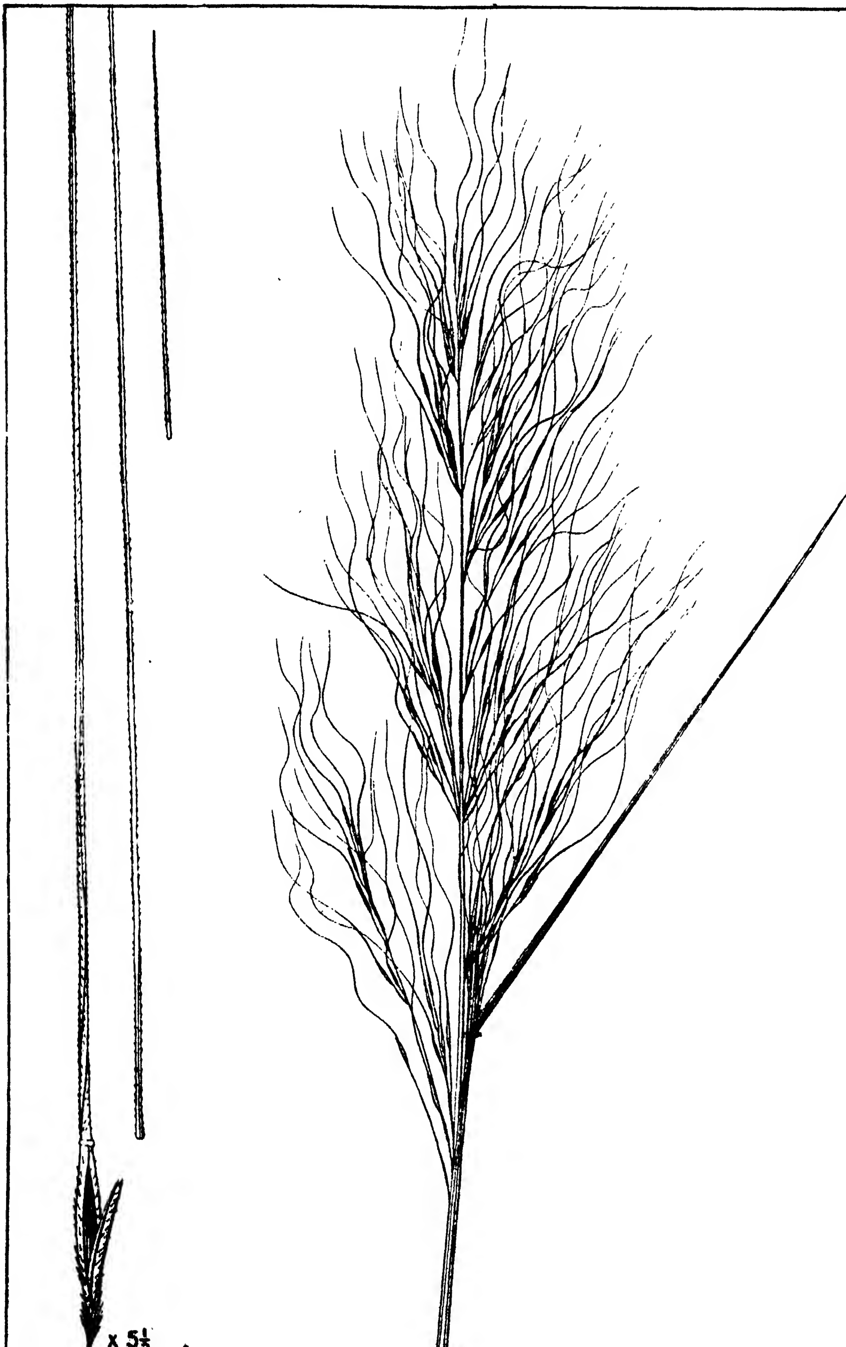


Fig. 2.—*Stipa scabra.*
Another common Corkscrew or Spear grass found on the Western Slopes and Plains.

2. They are amongst the first grasses to appear in late winter or early spring. This is the period when grass feed is particularly valuable, and the young growth of the varieties mentioned is palatable, and evidently nutritious for stock.

3. They are particularly adapted, owing to their drought-resistant qualities, to the dry summers of the Riverina, and are consequently abundant in this area.

The Stipa grasses in the northern districts of the State are much less abundant, and are generally much taller than those in the southern portions. One of the most important is *S. aristiglumis*, which has tall stems and wide but harsh leaves.

Management of Spear Grass Country.—Spear grasses should not be allowed to dominate the whole of the pastures. As the Danthonias grow well with Stipas, and are more palatable, it is possible to thicken up with Danthonias when necessary. That this can be done by scattering the seed in early spring amongst the Stipas, as has been proved by a pastoralist who is some distance inland.

If possible, sheep should be removed from the Spear grass pastures during the flowering period; otherwise the spear-like seeds will affect considerable damage to the eyes, mouths, and other parts of the animals. If a heavy seeding crop results, and the season turns out to be calm and dry, thus preventing the seed from falling to the ground, fires can be used. The writer, however, does not recommend the employment of fires unless under provocation, as they remove a great deal of mulch and organic matter from the earth, and destroy a considerable amount of seed, and render the new growth less capable of withstanding dry conditions.

Wire Grasses.—The most useful Aristida grasses are ***A. Behriana*** and ***A. leptopoda***, both very common on good soils in the Riverina. In their young stages they are very much appreciated by stock, but on reaching maturity their wide leaves become particularly harsh, and they are generally left alone.

Drought Resistance.—The Spear or Corkscrew and Wire Grasses are amongst the most drought-resistant of our native plants, and it is this fact, rather than their palatability, which renders them particularly valuable. Even in the coastal districts and the steep barren slopes of the Great Dividing Range, the Stipas will be found growing in the poorest and driest of soils, where little other vegetation is noticeable. The entire structure of these grasses is conducive to drought resistance. It will be noticed, for example, in *Stipa semibarbata*, that the root fibres are encased in a woolly investiture for protection, a most unusual feature in plants. This woolly casing is different from that previously described in the case of our western Love grasses. In the latter, root hairs were present on the old portion of the root, but the sand or earth casing had no hairs or wool intermingled with it, as in the case of the Stipas. The manner in which this dense, woolly blanket could protect the root from the scorching action of the hot surface-soil can easily be imagined.

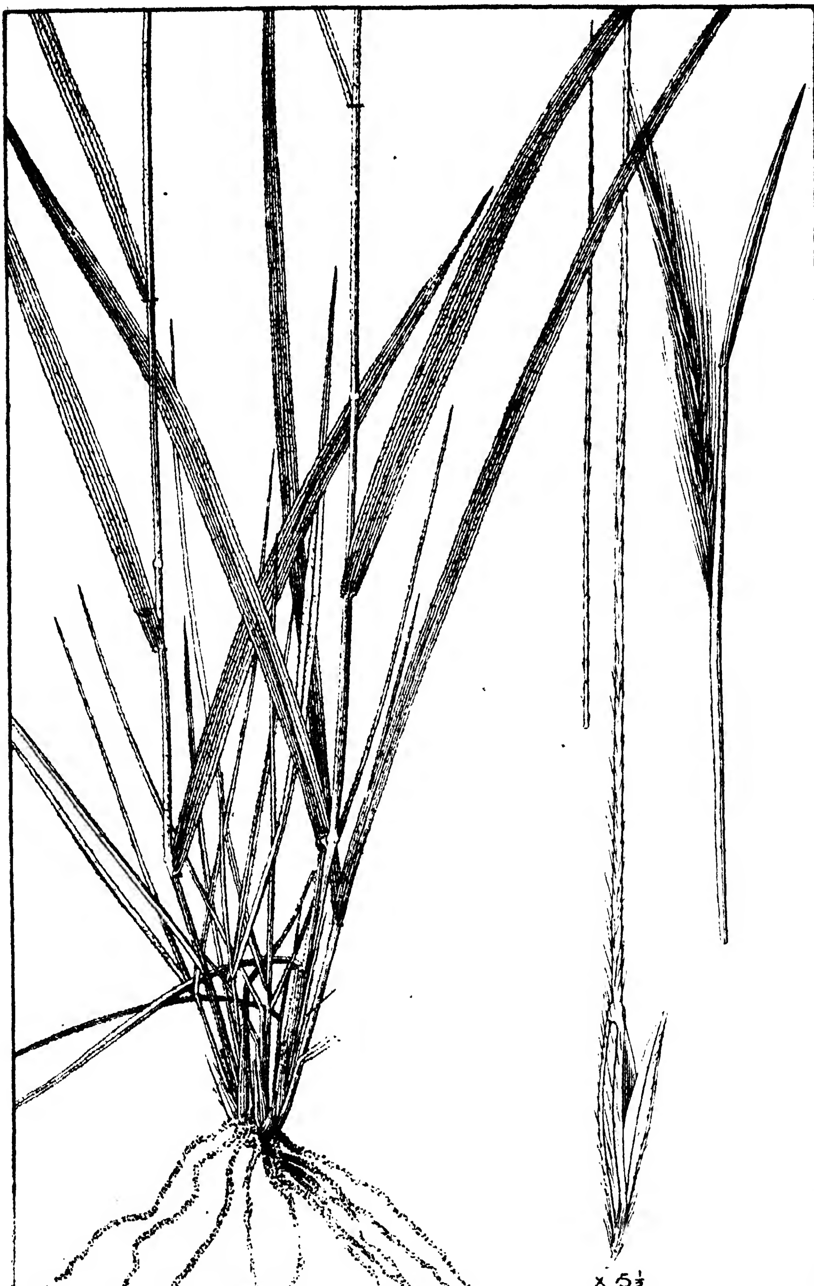


Fig. 3.—*Stipa semibarbata*.

A very hairy Corkscrew or Spear grass, found in the interior.

The leaves again are generally narrow and harsh in character, and in hot weather become completely rolled up, thus presenting as small a surface as possible for transpiration. When the leaves are wide, as in the case of *Stipa Tuckeri*, they are covered with a dense felt of hairs, which evidently also acts as a deterrent to excessive transpiration.

Where drought-resistant characteristics are extremely well developed, these grasses are practically useless for fodder purposes, except under extremely adverse conditions. This is particularly the case with the West Australian species (*S. eriopus* and *S. trichophylla*), which inhabit barren, desert soils. It is also the case with many of our own Aristida or Wire grasses, particularly *A. vagans*, *A. ramosa*, and *A. calycina*. The presence of these species generally indicates poor, barren soils.

Annual Stud Pig Sale at Hawkesbury Agricultural College.

The Annual Stud Pig Sale at Hawkesbury Agricultural College will be held on Wednesday, 16th March, at 12·30 p.m., when fifty specially selected pedigreed pigs (including Berkshires, Tamworths, Yorkshires, and Poland Chinas) will be offered at auction.

A train is timed to leave Central Station, Sydney, for Richmond, at 8·56 a.m., and vehicles will meet the train and convey buyers to the sale. Luncheon will be provided at the College, and buyers can return to the city by train leaving Richmond at 4 p.m. the same day.

Arrangements can be made for crating and despatching the animals, and the vendors will feed and attend to same pending despatch for only a nominal fee.

Catalogues and further particulars can be obtained from Messrs. Badgery Bros. (auctioneers) and the Principal of the College.

Ladybird Beetles and Potatoes.

Some interest was taken in the latter part of 1920 in damage that was being done by certain ladybirds to growing potato crops in the Hunter River district, and the question was raised whether it was not in reality pumpkin beetles that were responsible for growers' losses.

As a matter of fact, a common spotted ladybird often does considerable damage to the foliage of potatoes and tomatoes, though, of course, most of the ladybird beetles are very useful in destroying aphis, scab, &c. There is one group of the true ladybird beetles in the genus *Epilachna* (common in Australia) that are plant-eating in both grub and beetle stages, and the spotted leaf-eating ladybird beetle (*Epilachna 28-punctata*) is a large, dull, orange-yellow beetle, covered with black spots, not unlike *Leis conformis*, which is one of the most useful aphis-eating ladybird beetles. This species often feeds upon potatoes, doing a great deal of damage when numerous.

The pumpkin beetle, though a pest on melons, cucumbers, &c., never touches potatoes.—W. W. Froggatt, Government Entomologist.

"Yema" Budding of the Vine.

H. L. MANUEL, Viticultural Expert.

IN establishing a resistant vineyard on commercial lines to-day, three methods are adopted:—

1. Planting with bench-grafted rootlings.
2. Planting with ungrafts, and, in the spring-time, field-grafting with the cleft or whip-and-tongue.
3. Grafting ungrafts with the summer bud, known as "Yema" grafting.

Mr. F. De Castello, Government Viticulturist of Victoria, on a tour through Spain, observed the method of propagating with the Yema graft, and on his return to Australia put it into practice in Victoria, where it has proved a valuable addition in aiding the reconstitution of phylloxera affected areas

Mr. Rounce, the Superintendent of the Mirrool Nursery, Griffith, modified the cutting somewhat, and in both his modifications has simplified the operation. The Yema graft has many advantages over both the bench and the ordinary field (spring) graft. Being made in the form of a bud, a minimum injury to the stock results, and a better union between the stock and scion. The stock being already established, is better able to produce a good, strong shoot for the formation of the stem.

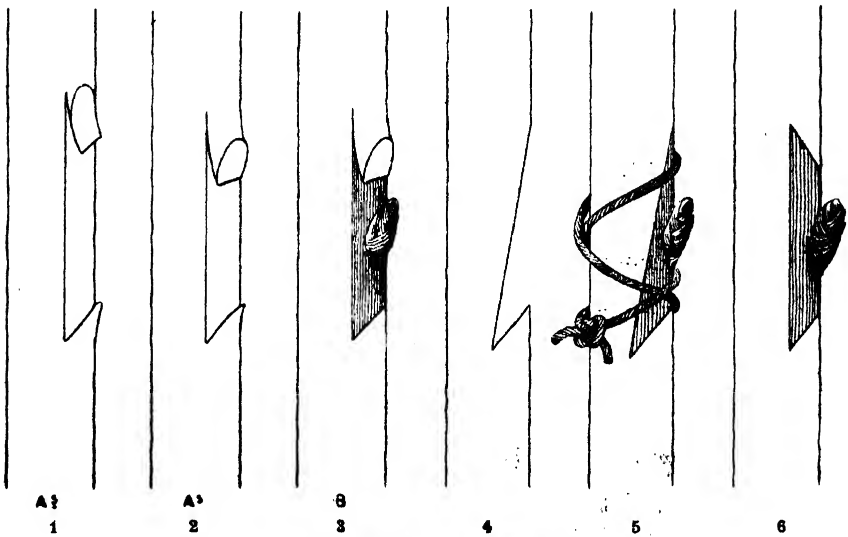
The operation of grafting is done in January and February, and even to the end of March, according to the condition of the vine—a time when the sap is flowing so as to produce an excellent callus, that is, when the temperature is warm and the period of greatest vigour in the vine has passed. The bud remains dormant until the spring, when it shoots out under normal conditions into very strong growth, having the advantage of a full growing season in front of it. An occasional bud may be found that remains dormant until the following year, and there are known cases (which are exceptional) of an odd bud remaining for two years before bursting.

With the ordinary field-grafting, which is done during the spring months when the sap is flowing very freely, and at a time when it is known to drown somewhat, the callousing takes longer and not with the same results as are obtained with the autumn working. The vine being weakened for the time being, and the growing period shortened, the vine is less able to produce a strong healthy shoot, and in some cases several short weak shoots result.

Vines that are planted in the spring and that grow well throughout the season, can be successfully Yema-worked in the following February or

March. In the case of weaker vines it is advisable to leave the operation until the following year. The stock should be growing well with a fair flow of sap before an attempt is made to Yema-graft it.

Scion-wood should be well matured and in size should equal, as closely as possible, the diameter of the stock. Supplies of scion-wood should be gathered from day to day so as to insure them being fresh, and they should be wrapped in a wet bag until required. For convenience when working in the field, from time to time cut the scion-wood into one-bud lengths, and carry them in a small bucket of water. A suitable bucket can be made from a kerosene tin by cutting it on the full length, so as to give a shallow depth.



Various Systems of Yema Budding.

1 to 5. Mr. J. C. Rounce's modification.

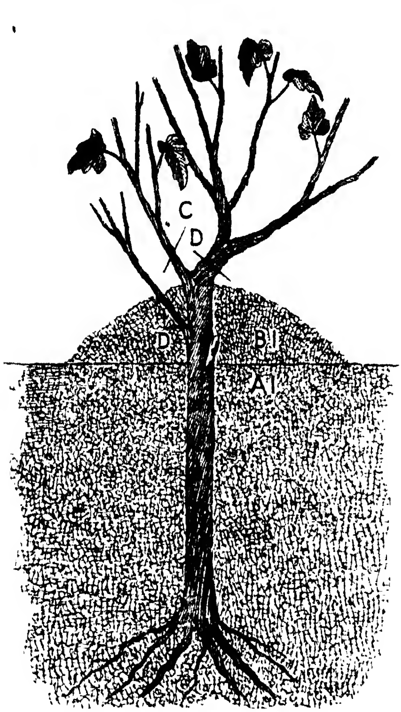
6. The original dovetailed method introduced by Mr. F. De Castello.

The operation of the Yema graft is as follows:—Remove a few spits of earth to form a basin around the stem (as shown in A 1 on the next page). About an inch above the level of the surface soil remove a piece of wood from the stock (as shown at As above), and into this insert a bud cut from the scion-wood as shown in B. It is advisable to tie the bud, although some skilled hands at the work omit to do so. A half thickness of bag thread will do to make the tie, or even a piece of raffia will suffice.

After the bud is tied, fill in carefully, covering the bud well over as in B1. The bud simply callouses and remains dormant until the spring. During the winter months the vine can be cut back to one spur of a couple of buds (as shown at C in the second illustration), all the other American wood being removed as at D.

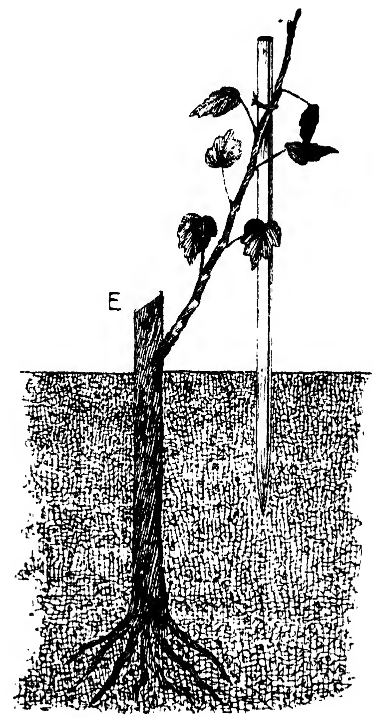
At a period shortly before the bud is likely to burst, say in August, the mound should be removed, leaving the bud exposed, and when the bud

finally bursts out the spur can be cut off a couple of inches above the young shoot (as shown at E in the third illustration). Closer cutting than this will injure the knitting of the union. The projecting piece can be cut back close the following year, if all is well with the union.



Yema Bud, inserted in Autumn.

The bud can be seen on the line of the surface; soil mounted up; wood to be removed as marked.



The Bud in Spring.

Note the growth of the bud and the cutting back of the stock.

Periodically throughout the spring and summer attention must be paid to the disbudding of the resistant shoots that may grow, and the young European shoot tied to a stake to prevent the wind from injuring it. The knife most suitable for the operation is a narrow-bladed one, having a razor edge. A good pocket knife with a steel blade that is worn somewhat is ideal, if it is well sharpened.

Oats and Barley as Poultry Foods.

Are oats (either crushed or whole) economical feed for fowls?

It has to be remembered that the bushel of oats is only 40 lb., whereas the bushel of wheat is 60 lb. Oats are a good feed for fowls up to a certain point, that is, it is not advisable to feed on oats alone. A third to one-half of the evening feed may be of oats if a plump variety, such as Tasmanian white oats, is in use. The same applies to barley.—James Hadlington, Poultry Expert.

The Influence of Atmospheric Variations on the Weight of Bagged Wheat.*

F. B. GUTHRIE, G. W. NORRIS, and J. G. WARD.

IN connection with the work of a sub-committee appointed by the Advisory Council of Science and Industry to inquire into the question of weevils in wheat, it was thought desirable to ascertain to what extent the moisture-content of bagged wheat varied with the changing moisture content of the air.

Through the kindness of Mr. G. W. Walker, of Messrs. Lindley, Walker and Co., a bag of freshly-harvested wheat was therefore obtained direct from the field during the harvest of 1917-18, and its weight was taken daily for a period of nearly two years. It is assumed that increases and decreases in weight represent gain or loss of moisture.

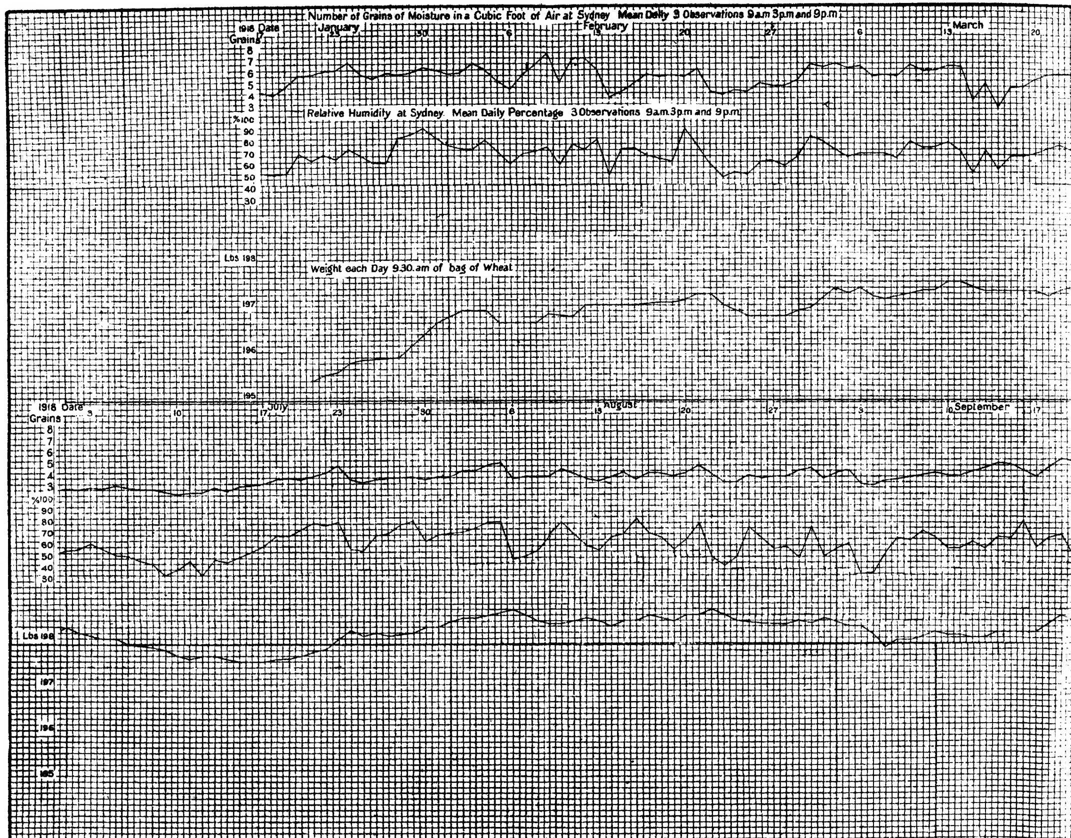
The accompanying graphs show how the variations in the weight of the wheat correspond with the variations in atmospheric humidity. The lowest of the graphs shows the daily variations in the weight of the bag of wheat weighed daily at 9.30 a.m. (Sundays and holidays excepted) from 21st January, 1918, to 8th December, 1919. The weight of the bag is given in pounds and ounces, and the pound is subdivided into eight parts, each line representing, therefore, two ounces.

The weight of the bag (or rather of another similar bag) was also taken daily for a period, but as the weight of the bag was only 2 or 3 lb. and varied so slightly as not to affect the total weighing, this was discontinued, and the figures given represent the total weight of wheat and bag, the variations due to the loss or gain of moisture by the bag itself being negligible. For the sake of clearness the dates are only recorded at intervals of one week—every second line representing one day. The first day of each month is distinguished by a thick line.

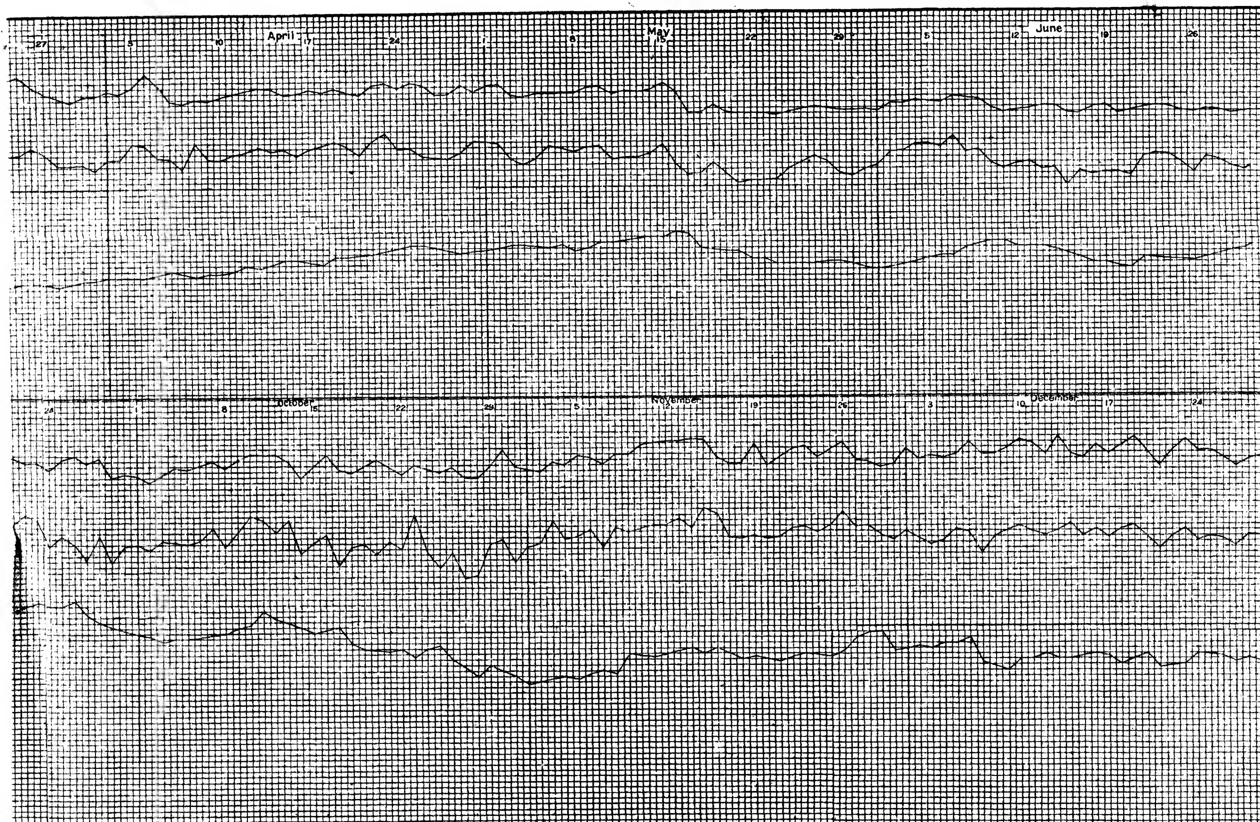
The bag was suspended from the roof of the laboratory, and to be weighed was lowered on to a small weigh-bridge by means of a pulley. The ropes and the beams and rafters were protected from rats by means of metal shields.

The changes in the humidity of the air are presented in the two upper graphs, and are taken from the daily observations made by the Weather Bureau. The distance of the Observatory from the chemist's laboratory is not more than 400 yards in a direct line, and it may be assumed that the atmospheric conditions are identical, except that the wheat was weighed under cover, and the surrounding air was not likely to be subject to the same rapid changes as is the case with the open air.

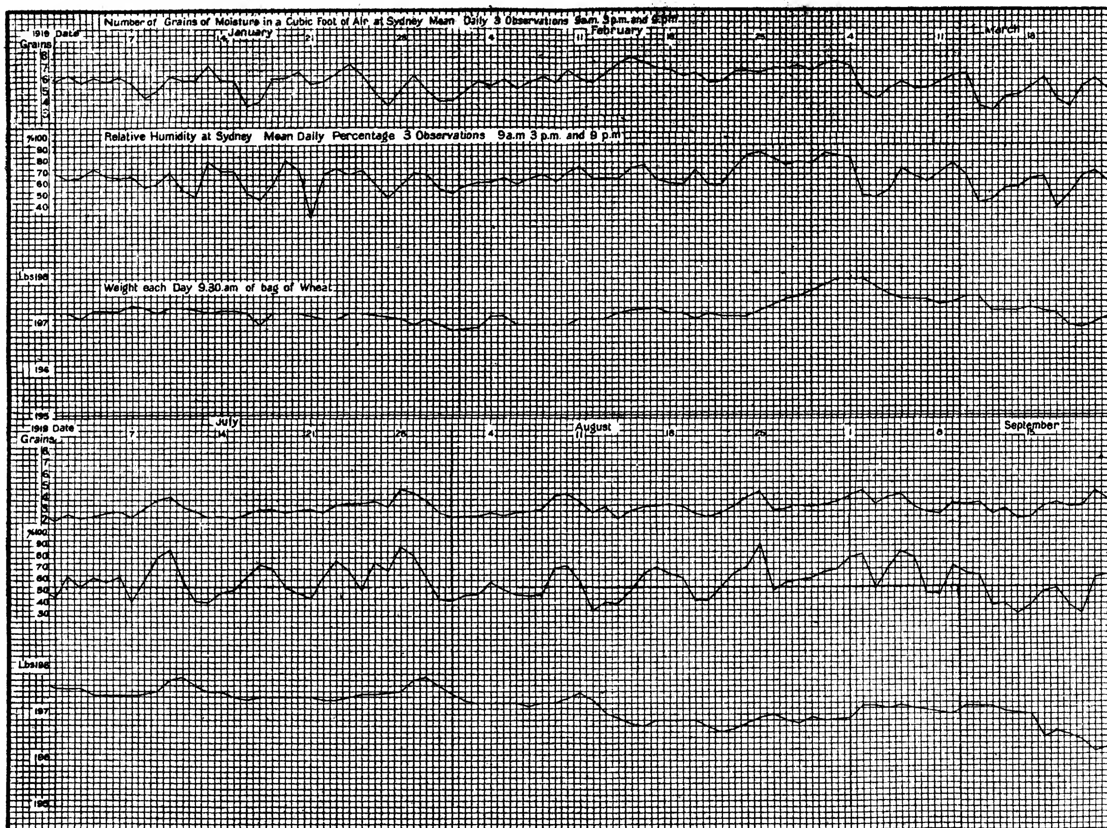
[* Read before the Agricultural section, Australasian Association for the Advancement of Science, Melbourne, January, 1921.]



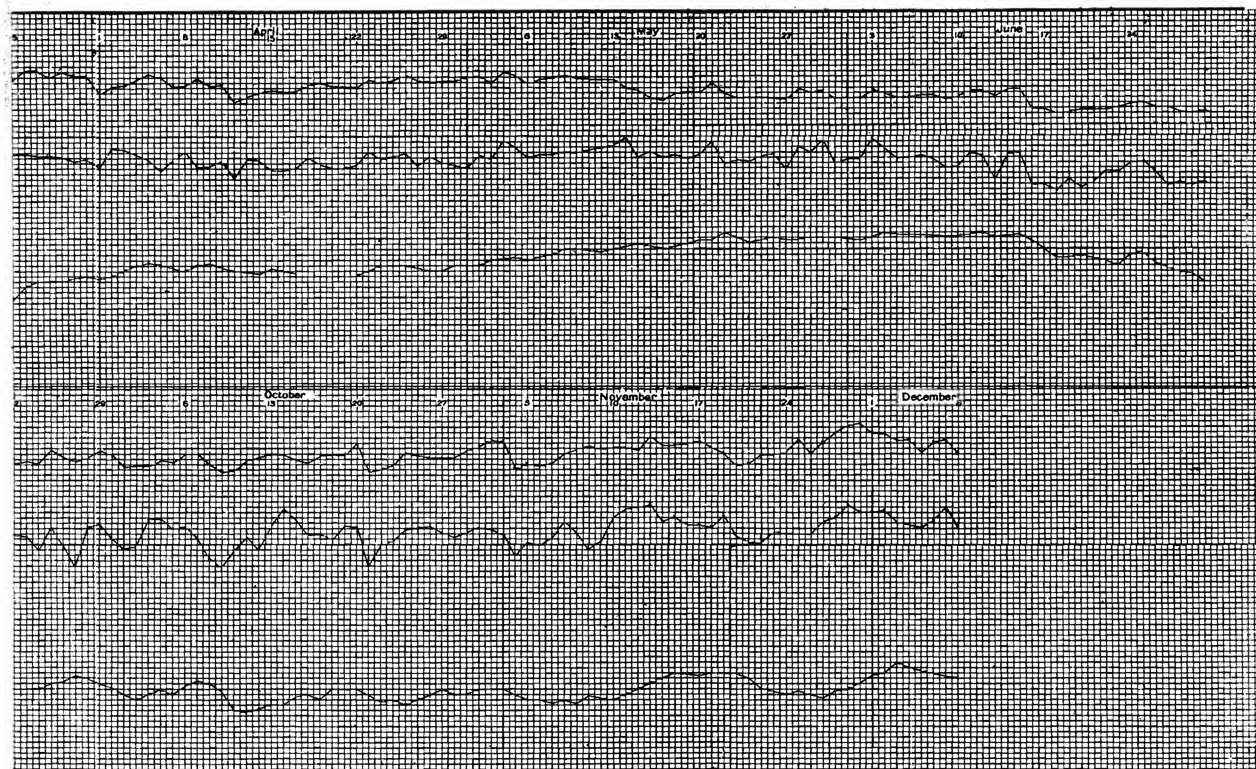
Graph showing the Influence of



Atmospheric Variations on the Weight of Bagged Wheat.



GRAPH showing the Influence of Atm



ospheric Variations on the Weight of Bagged Wheat (*continued*).

The upper graph represents the number of grains of moisture per cubic foot held by the atmosphere. Each daily value was obtained by extracting the mean of three observations taken at 9 a.m., 3 p.m., and 9 p.m., and thus conveys a correct idea of the nature of the atmosphere affecting the wheat on that day. Each horizontal line in this graph represents half a grain.

The figures upon which the centre curve (relative humidity) was based were obtained by the same method, and this graph depicts the variations in the relative humidity or the amount of moisture suspended in the air, shown as a percentage of the amount it would be capable of holding if saturated at that temperature. In this graph each line represents 5 per cent. relative humidity.

The original weight of the bag as received, 21st January, 1918, as will be seen from the graph, was 195lb. 6oz.

The bag immediately commenced to gain in weight, until about 3rd February, without responding to any slight changes in local atmospheric conditions.

From this point the graphs may be compared, and it will be noted that on the whole the three graphs compare fairly well with each other, any appreciable lowering of the moisture content being followed in a day or two by a corresponding decrease in the weight of the bag. Similarly a rise in moisture content precedes an almost immediate increase in weight.

The increases and decreases in the weight of wheat are, however, much smaller than the increases and decreases in humidity. Generally speaking, there is a gradual increase in the weight of the bagged wheat from early in February, 1918, when it had accustomed itself to its new atmospheric conditions, until about 14th or 15th May, 1918, when the maximum weight recorded is reached, namely, 198lb. 10oz.

The weight remains about or above 198lb. until 11th or 12th of October, after which date it drops quite rapidly to 196lb. 10oz. by 1st November, and remains in the neighbourhood of 197lb., seldom reaching 198lb., during the summer months, and until the end of February, 1919.

During the summer months—January and February—the weight never exceeds a couple of ounces over 197lb.

There is then a sudden increase in weight from the end of February, to about 4th March, 1919, followed by a drop at about 22nd March, both of which changes were preceded by a corresponding rise and fall in the humidity graph.

From this date the weight increases steadily during the autumn months to over 198lb. in the middle of June, after which it never rises above 197lb. during the dry months experienced.

On 2nd December, 1919, it had risen to 197lb. 8ozs., shortly after which the experiment was discontinued.

It is interesting to note that the highest recorded weight was 198 lb. 10 oz., which was reached on two occasions—5th August, 1918, and 21st May, 1919—and that the lowest weight (after it had adjusted itself to its new environment) was 196 lb. on 14th October, 1919.

This represents a range from the original weight of 195 lb. 6 oz. to 198 lb. 10 oz. On the assumption that the grain was harvested in a hot and dry atmosphere, and was at its driest and lightest when received, the effect of storing it in the comparatively moist atmosphere of Sydney results in a maximum variation of 3 lb. 4 oz. in a bag of wheat weighing 195 lb. 6 oz., or 1·4 per cent.

The period during which the experiment was carried on proved an excellent one for the purpose, as it contained many sharp variations in the atmospheric moisture content, alternating with groups of days of average humidity.

It is noteworthy that the weight of the wheat followed fairly closely nearly all these rapid changes in the state of the atmosphere.

It would appear that at first the gradual and persistent rise in the weight of the wheat indicates the inclination of the grain to absorb moisture, and an apparent reluctance to part with it until it has absorbed the maximum, after which a reverse state of affairs prevails, and in spite of more humid conditions the grain does not increase in weight, but readily responds to dry conditions and parts with its moisture. It will be seen that when the experiment was abandoned, the final weight of the wheat was very nearly what it was when it had accustomed itself to its new surroundings—about a fortnight after it had been received.

Conclusions.

The conclusions may be summarised thus:—

1. Wheat harvested under hot and dry conditions rapidly increases in weight when brought into a cooler and moister atmosphere.
2. Subsequent variations in weight are slight and vary generally with the atmospheric humidity, a rise or fall in the humidity being followed almost immediately by a corresponding rise or fall in weight.
3. The variations in weight of bagged wheat harvested under hot and dry conditions and stored in a cooler and more humid atmosphere do not exceed 1½ per cent. over a period of two years.
4. After the wheat has been stored for two or three weeks and has adjusted itself to the new conditions, the variations in weight are much less.

Spread of Another Bad Weed.

The Californian Stinkweed, *Gilia squarrosa* Hook. et Arn. (Polemoniaceae), is figured in Ewart and Tovey's "Weeds of Victoria." It is exceedingly common in Victoria, and has for a number of years been recorded from the Tumbarumba district, as mentioned by me in the Gazette for April, 1901. I had hoped that it would confine itself to the cold regions of Tumbarumba, and I have not heard of it as spreading in any other district until quite recently, when I received it from the Yass district.

It is a rather prickly plant, about 2 feet high, the numerous small bluish flowers in the head being surrounded by rigid bracts. It has not a pleasant smell, hence its common name.—J. H. Maiden.

Some causes of Co-operative Failures.

C. C. CRANE, Organising Inspector of the Agricultural Bureau.

LIKE all things worth the doing, the maintenance of a healthy co-operative association is beset by certain difficulties and problems. Associations enthusiastically launched have been known to founder, and many others have shipped heavy seas before ultimately reaching smooth water. Enthusiasm is an excellent thing—so long as its decisions defer to certain elemental laws.

Lack of Efficient Management.

A successful manager requires to have had an expert business training in all the lines with which he is operating; he must be as well or better trained than the men who are operating in competition or opposition, and he must have administrative ability, integrity, and tact. Too often a co-operative society appoints a local man (possibly one of its members) as manager because he is popular and possesses some general qualifications rather than because he has any particular and specialised ability which fits him for the post. Too often an expert manager is unwisely restricted by members of the board, who have general but not expert knowledge, and who forget that while it is their duty to adopt a policy, it is essentially the manager's business to administer it, and that to do this efficiently he must be allowed considerable latitude and independence of action. Finally, it must be remembered that as the position of manager calls for a specialist's qualifications, it calls also for a specialist's remuneration.

Lack of Loyalty of Members.

The foundation-stone of any co-operative society is the individual member, and in a co-operation of producers his loyalty is of special and paramount importance. Loyalty means personal interest, enthusiasm, confidence, and complete support.

To ensure loyalty the initial cost of becoming a member should not be too small for the sum invested to be looked upon as a stake in the society the loss of which would be of importance to the member. Each member should feel that he has something to lose, something to gain, and that his interest is not merely sentimental but principally monetary. Steps must be taken by the secretary or committee where necessary to keep members well informed, and to explain positions that, if left in doubt, would cause uneasiness, or possible defection. Producers' co-operations have frequently found it advisable to insist that members deal exclusively with the co-operative business, and to insure against defection by instituting a scale of fees that must be paid as liquidated damages in respect of all business passed through outside agents or transacted privately by members.

Opposition.

The question of opposition is closely allied to that of loyalty; for, while loyalty is maintained opposition must be ineffective. Rival companies and private competitors are likely to put up opposition in proportion to the menace that the co-operative association seems to promise to their interests, and steps calculated to cripple it may be expected at the earliest opportunity. Prices will be cut and inducements offered to members that will possibly appear extremely attractive.

The individual must be made to realise that concessions and benefits made at such a time by competitors are temporary, and due to the existence of the co-operative association. The association should be in a position to work more economically than any other concern legitimately could, and the committee should take steps to convince members that their prices represent the minimum when selling and the maximum when buying, and that finer prices represent a loss or at least a serious risk. The committee should see that members are kept informed as to (1) the benefit they have received from the association; (2) the prospects the association opens up for them; and (3) the possible results of the association's failure.

Isolation.

As the individual is the unit of the association, so must the association be but a unit in a co-operative federation; that is, the local association should retain its individuality, but should by affiliation with others secure for itself as a society what it has as a union secured for the individual. In short, while local individualism is a necessary feature of the co-operative movement, a co-operative union or federation and a co-operative wholesale are equally essential. No society should endeavour to exist as an isolated co-operative undertaking.

Operating on too Small a Margin

Generally speaking, a co-operative association should not set out with the immediate object of cutting prices; it should pay current rates when buying, and charge current prices when selling, for such will give a sufficient margin to tide the concern over times of distress. If at the conclusion of the financial period it is found that customers have been paid too little for their produce, or have paid too much for the goods they have purchased, this must be refunded to them *pro rata* of the business each individual member has effected with the association.

Unsuitable Scale of Operations.

Organisation should not be considered satisfactory till there is a sufficient volume of business in sight to reduce to a satisfactory minimum the overhead charges which are a necessary cost on buying and selling. The larger the bulked trading transactions effected through the society the greater will be the reduction in cost to the individual.

A society must learn to walk before it can run, and its magnitude must depend on its capitalisation; under-capitalisation means buying on terms and increases cost in every direction.

Purchase on the Credit System.

The main aim in co-operation is to effect economy. Credit dealing is expensive and uneconomical, and, however inconvenient it may be for members to pay cash, the importance of the cash purchasing principle in co-operative work is sufficient to warrant that inconvenience being imposed upon members. Generally speaking, if a co-operative society gives credit to its members it must ask for credit from its wholesale suppliers.

THICK OR THIN SEEDING FOR WHEAT?

A FARMER in the Central Western District asked for data as to the relative values of thick and thin seeding. In reply, the results of the experiments carried out by the Department were summarised as follows:—

1. Thick seeding has given the best results in good seasons, and the later the sowing the thicker should be the seeding.

2. Thick seeding has also given the best results with sparse stooling varieties, such as Florence.

3. What constitutes thick seeding in one district may be medium or thin seeding in another. For instance, medium seeding at Glen Innes is 1 bushel per acre, and when sowing is done late in the season (say in July) up to 1½ bushels are sown, but at Trangie and Nyngan the best results over a period of years have been obtained with from 35 lb. to 40 lb. of seed per acre, while further west still the sowing is still lighter.

4. Size of grain, stooling habit of the variety, time of sowing, moisture content of seed-bed, and average climatic conditions are all factors which have to be considered. Climatic conditions are variable, of course, and for this reason all departmental tests, when averaged over a period of ten years, give the best results from medium seeding.

As the farmer cannot tell in advance what the climatic conditions of the season will be, the safest plan is to employ a medium seeding, subject, of course, to reservations as regards time of sowing, etc.—R. G. DOWNING, Senior Experimentalist.

SOME RESULTS FROM THE DEPARTMENT'S GRASS SEED.

MR. J. W. BARRATT, Public School, Bulga, has supplied the following notes on grasses and clovers grown by him from seed supplied by the Department:—

Bokhara Clover.—Sown July, 1919; cut several times last year, last cut December, 1920; present height 3 feet.

Phalaris bulbosa.—Sown 10th July, 1920; 2 feet high in December, 1920; part cut 30th December.

Giant Fescue (*Festuca arundinacea*).—Sown 10th June, 1919; cut October and December, 1920; grew very slowly for first twelve months, but has stood the dry weather well; present height 3 feet 6 inches.

Warrego Summer Grass (*Panicum flavidum*).—Sown 10th June, 1919; cut March, August, and December, 1920; good dry weather grass; present height 3 feet.

Chilian Clover.—Sown 10th July, 1920; flowered December.

Coolah Grass.—Present height 4 feet.

Plants which Produce Inflammation or Irritation of the Skin.*

J. H. MAIDEN, I.S.O., F.R.S., F.L.S., Government Botanist and Director, Botanic Gardens, Sydney.

A LADY student in the Agricultural School at the University drew my attention to what is known as "brigalow itch" in the Moree district. Brigalow is a wattle, with the botanical name of *Acacia harpophylla*, and it is illustrated and described in Part 34 of my "Forest Flora of New South Wales."

The Chief Inspector of Stock informed me that the Inspector of Stock at Moree advised him as follows:—

> I do not know anything of the brigalow itch personally, but I have been informed by old hands that when ringing the brigalow, a fine powder, thought to come from the bark of the tree, caused an itching and irritated the skin, which would break out in eruption. The powder is described as very fine and yellow in colour.

Reference to the Forestry Commission has brought a number of interesting reports, some of which, although they are not evidence in regard to brigalow, form an interesting supplement to our knowledge regarding the connection between plants and skin irritation:—

Dubbo.—Nothing is known of brigalow itch, but many timber-workers, where there is no brigalow, are troubled with an itch. An insect (locally known as "giggles") in the Bogan River, causes an itch.

Forbes.—Nothing is known of brigalow itch, but a hairy grub which attacks myall trees (*Acacia pendula*) leaves behind a large bag which when disturbed exudes a fine dust, which on coming into contact with the body causes an intense irritation.

Deniliquin.—Brigalow does not grow in this district, but an itch is known to have been caused by the brown dust blown from the cocoons of the bag moth on myall (*Acacia pendula*) and yarran (*Acacia homalophylla*) trees. An itch very common in the red-gum (*Eucalyptus rostrata*) forests is caused by the decayed cocoon (of a moth) which is often under the loose bark on the gum trees. When this dust comes into contact with a man's body it causes a most tormenting itch which is almost unbearable, but it only appears to take effect when the body is heated.

Narrabri.—An itch commonly called brigalow itch has been prevalent in this district for some time past, but people have been known to suffer from it who had never even seen a brigalow. In brigalow country, especially in wet weather, the itch is bad, and would appear to have been caused by the tree. It does not last long, and one is rid of it next day. Dr. Park, of Narrabri, informed the District Forester that he has had a number of cases of various forms of "dermatitis", but solely from men who had been cutting pine (*Callitris*) whilst the trees were laden with pollen, or who had been cutting Noogoora burr (*Xanthium strumarium*) [see this *Gazette* for 1899, p. 1043]. Dr. Park was of the opinion that these men were affected by the burr and the pine, as the symptoms recurred when they went back to work. He also noticed that only persons inclined towards eczema and persons with very tender skins were so affected, and that he had known many men employed in ringbarking and working among brigalow at all seasons and in all weathers who never felt any ill effects. The District Forester states that after rain there is always a most unpleasant odour hanging around the brigalow scrub which can be best described by likening it to the scent left by a fox.

* Previous references :—June, 1920; May, 1918; March, 1916.

Analyses of Saltbush.

F. B. GUTHRIE.

SOME time ago the secretary of the Advisory Council of Science and Industry was making inquiries concerning the commercial utilisation of *Atriplex nummularia* (old-man saltbush) for the production of potash, and asked for any information available on this point. As we had no records of deter mination of potash in the ash of saltbush, samples were obtained from the Manager of Nyngan Experiment Farm, who kindly supplied fresh plants of three varieties common in the district, the local names for which were given as creeping saltbush, red-berried saltbush, and old-man saltbush.

These were identified by Mr. J. H. Maiden, I.S.O., F.R.S., Director, Botanic Gardens, Sydney, as *Atriplex* sp., *Chenopodium triangulare* R.B., and *Atriplex nummularia* respectively. The creeping saltbush may be *Atriplex leptocarpum*, F.v.M. They were reduced carefully to ash, and the following tables give the composition—firstly of the crude ash, and secondly, for the sake of more accurate comparison, of the pure ash, exclusive of carbonic acid, sand, and charcoal :—

ANALYSES of Ash of Saltbush.

	Creeping Saltbush.	Red-berried Saltbush	Old-man Saltbush.
Carbonic acid (CO_2)	10·36	15·22	7·69
Sand...	5·56	6·86	2·44
Charcoal	0·60	1·68	1·40
Silica (SiO_2)...	4·83	4·25	2·16
Iron and alumina (Fe_2O_3 and Al_2O_3)	0·93	2·78	3·85
Lime (CaO)	7·36	15·14	5·29
Magnesia (MgO)	3·94	3·10	1·94
Potash (K_2O)	34·96	29·96	13·88
Soda (Na_2O)...	8·38	5·55	32·15
Chlorine (Cl)	23·87	12·64	30·25
Sulphuric acid (SO_3)	2·80	2·94	4·46
Phosphoric acid (P_2O_5)	1·98	1·96	1·49
	105·57	102·08	107·00
Deduct Oxygen equivalent of Chlorine... ...	5·38	2·85	6·80
Total	100·19	99·23	100·20

COMPOSITION of Pure Ash, exclusive of carbonic acid, sand, and charcoal.

	Creeping Saltbush.	Red-berried Saltbush.	Old-man Saltbush.
Iron and Alumina (Fe_2O_3 and Al_2O_3)	1·11	3·64	4·35
Lime (CaO)	8·82	19·85	5·98
Magnesia (MgO)	4·72	5·16	2·20
Potash (K_2O)	41·88	39·29	15·69
Soda (Na_2O)	10·04	7·28	36·34
Silica (SiO_2)...	5·78	5·56	2·44
Chlorine (Cl)	28·59	16·60	34·19
Sulphuric Acid (SO_3)	3·35	3·86	5·04
Phosphoric Acid (P_2O_5)	2·37	2·57	1·68
	106·66	103·81	107·91
Deduct Oxygen equivalent of Chlorine	6·44	3·74	7·71
	100·22	100·07	100·20

It would appear from these figures that, regarded as a possible source of potash, the creeping saltbush is the most satisfactory of the three varieties, whilst old-man saltbush contains less than one-half the potash present in the other varieties, its place being taken by soda in the form principally of sodium chloride.

Value of Saltbush as a Fodder.

It may be of interest to republish here some analyses made by me many years ago to determine the fodder-value of several varieties of saltbush from Bourke and Hay in New South Wales. The figures are calculated to dry substance, as the moisture-content varied considerably on arrival at the laboratory, some, especially of the smaller-leaved varieties, having become very dry. It may be stated that when quite fresh the leaves of saltbush contain about 75 per cent. water.

The specimens were identified by Mr. J. H. Maiden. The names and localities are as follows :—

A. *Atriplex nummularia*, from Bourke.
B. *Rhagodia parabolica*.
C. *Atriplex halimoides* (mixed with a species of *Atriplex*), from Bourke.
D. *Rhagodia Billiardieri*, (probably) from Hay.
E. *Atriplex angulata*, from Hay.
F. Unidentified, from Hay.

ANALYSES of Saltbush from Bourke and Hay, calculated to dry substance.

	A.	B.	C.	D.	E.	F.
Oil	1·54	2·06	2·10	1·88	3·27	1·83
Digestible fibre	26·78	22·17	23·06	18·91	10·20	26·99
Woody fibre	9·08	18·68	13·45	11·01	21·87	12·27
Soluble albumenoids	4·06	3·56	2·92	5·46	3·04	3·86
Insoluble albumenoids	8·19	6·93	3·56	8·53	2·91	5·97
Soluble ash	32·68	24·68	26·78	30·64	29·15	28·75
Insoluble ash	4·71	5·81	3·83	3·90	19·49	4·84
Chlorophyll, amides and other extractives (by difference)	12·96	16·11	24·80	19·67	10·07	15·49
	100·	100·	100·	100·	100·	100·
Total Nitrogen	2·76	·60	2·48	3·66	1·84	1·95
Amide Nitrogen	·80	·92	1·44	1·42	·89	·58
Percentage of common salt in ash ..	56·6	44·7	59·5	44·3	49·9	59·7

The amount of water in the different samples examined was, as has been said, extremely irregular, some of the samples having become very dry in transit. The actual percentages of water in the specimens as received were as follows :—

A ...	... 56·73	D ...	... 63·41
B ...	... 41·86	E ...	... 38·64
C ...	... 40·48	F ...	... 50 88

The figures in the above table giving the percentage of common salt in the ash were calculated on the assumption that all the chlorine present was in combination with sodium as sodium chloride. The analyses of the ash previously quoted show that quite a considerable proportion exists as potassium chloride.

In order to compare the fodder-value of saltbush with that of other common green fodders, the following table has been compiled, in which the analytical figures are presented in the form in which they are usually set forth in fodder analyses and re-calculated to a moisture-content of 75 per cent. For the sake of brevity, the three samples from Bourke (A, B, C,) and the three from Hay (D, E, F,) have been averaged separately.

Comparison of Saltbush with Other Green Fodders.

	Average of three samples from Bourke.	Average of three samples from Hay.	Maize.	Sorghum.	Lucerne.	Timothy Grass.
Water	75·00	75·00	79·3	79·4	71·8	61·6
Oil	·47	·61	·5	·5	1·0	1·2
Albumenoids	2·37	2·52	1·8	1·3	4·8	3·1
Carbohydrates	10·55	7·78	12·2	11·6	12·3	20·2
Woody fibre	3·52	3·98	5 0	6·1	7·4	11·8
Ash	8·09	10·11	1·2	1·1	2·7	2·1
	100·	100·	100·	100.	100·	100·
Percentage of common salt in ash	53·06	51·03				

A comparison of the above shows that the saltbushes take a high place among green fodders, the amounts of carbohydrates and albumenoids being high, and the woody fibre relatively low. The high content of mineral matter, especially of common salt, is of course characteristic. In discussing their merits as fodder, it must not be forgotten that they possess natural advantages over the ordinary cultivated crops or pasture grasses. They flourish on land which will not support other nourishing plants ; they resist drought to an exceptional degree ; are indigenous, and require no cultivation ; are relished by stock, and are exceedingly prolific and easily propagated.

It would appear, however, in spite of the universal recognition of these facts by stockowners, that there is some danger of these plants becoming less abundant than formerly, through overstocking and other causes.

In California they have imported a number of species from Australia for the purpose of cultivating it on the alkaline soils of that State. If it is

worth while to import saltbush for cultivation in California, it is surely worth while to encourage these plants in our drought-stricken districts, if only to the extent of preventing them from being kept eaten down by overstocking.

It should be possible, if it were seriously attempted, to assist their propagation materially, as they grow readily and prolifically from seed, from cuttings, and from the root. In good seasons there seems to be no reason why saltbush should not be cropped like lucerne and conserved as dry fodder for times of drought.

Points in Transportation of Bees.

The essential points to consider when transporting colonies of bees are:—(*a*) The provision of ample ventilation; (*b*) the fastening together securely of all hive parts, including wedging of frames firmly together; and (*c*) the removal from the hive of all combs heavy with honey. The temperature must of course be taken into consideration when provision for ventilation is being made; so also must the population of the colony and the distance to be travelled.

The procedure in preparing for transport a hive that contains a fairly populous colony during warm weather should be as follows:—

1. Remove for separate transportation any combs heavy with honey: these can be replaced with empty combs.

2. Make all self-spacing frames firm by crowding together and inserting wedges between the outside frame and the wall of the hive.

3. Place an empty super on the hive.

4. Fasten the bodies of the hive together (and, if possible, the bottom board) with sound strips of board—one vertical strip at the rear and one on each side of the corner near the entrance, making sure that the bottom board is secure.

5. Fit a full-sized wire cloth screen on top of the empty super and fasten on with cleats, setting double cleats at each end, so that the cover can be placed on without interfering with ventilation.

6. When the bees have finished work for the day, press a strip of wire cloth into the hive entrance and then securely fasten with thin cleats.

At night or during cool weather colonies can often be removed short distances with less preparation as far as ventilation is concerned: for instance, an empty super may not be necessary. It should be understood, however, especially by beginners, that too much ventilation is far better than not enough; also, that it pays well to make all hive parts firm and see that there are no cracks in the bottom board through which the bees might escape.—W. A. Goodacre, Senior Apiary Inspector.

Only roses that flower freely and continuously are suitable for the cut-flower trade. If a train journey of any length has to be taken into consideration J.J.L. Mock and Radiance are to be recommended as good pink varieties, Hadley as a good all-round red rose, and Warrior as a good winter-flowering sort.—E. N. Ward, Superintendent, Sydney Botanic Gardens.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture now publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of wheat, oats, maize, sorghum, Sudan grass, potatoes, and other crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

This list is compiled after inspection of the seed and report by a field officer of the Department (preferably during the growth of the crop), and farmers who have pure high-class seed of good quality of any variety of farm crop are therefore invited to communicate with the Under Secretary and Director, Department of Agriculture, Sydney.

The Department does not undertake to buy any of the seed, but recommends the grower by publishing his name in this list. The following list indicates where pure seed, recommended by the Department, is at present obtainable :—

Wheat :—

Billy Hughes	Manager, Experiment Farm, Condobolin.
Bomen	Manager, Experiment Farm, Temora.
	E. J. Allen, Gregra.
Canberra...	Tayler, Lloyd and Co., Adavale, Parkes.
	S. M. Haig, Lisburn, Wombat.
	E. J. Allen, Gregra.
	R. J. O. Berryman, Anicmoore, Botfield's Siding.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
Clarendon	E. J. Allen, Gregra.
	Manager, Experiment Farm, Condoblin.
College Purple	Manager, Experiment Farm, Temora.
Comeback	Manager, Experiment Farm, Temora.
Currawa	Manager, Experiment Farm, Temora.
Federation	Manager, Experiment Farm, Temora.
Firbank	Manager, Experiment Farm, Nyngan.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
Florence...	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Trangie
	Manager, Experiment Farm, Condobolin.
Genoa	Manager, Experiment Farm, Glen Innes.
Gresley 83	Manager, Experiment Farm, Temora.
Hard Federation	E. J. Allen, Gregra.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Condobolin.
Improved Steinwedel	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
King's Red	Manager, Experiment Farm, Temora.
King's White	Manager, Experiment Farm, Temora.
Marshall's No. 3	Manager, Experiment Farm, Temora.
Marquis	Manager, Experiment Farm, Glen Innes.
Major	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Temora.
Penny	W. A. Graham, Rippingham Grange, Barellan.
	E. J. Allen, Gregra.
	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Temora.
Red Wing	Manager, Experiment Farm, Condobolin.
Rymer	W. A. Graham, Rippingham Grange, Barellan.
	E. J. Allen, Gregra.
Thew	Manager, Experiment Farm, Glen Innes.
Turvey	W. W. Watson, "Woodbine," Tichborne.
Warren	Manager, Experiment Farm, Trangie.

PURE SEED—*continued.*

Wheat—continued.	
Warden	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Temora.
Yandilla King	W. L. Forsyth, Braeside, Wallendbeen.
	E. J. Allen, Gregra.
	S. M. Haig, Lisburn, Wombat.
	Manager, Experiment Farm, Temora.
Zealand	Manager, Experiment Farm, Temora.
Oats :—	
Algerian	Manager, Experiment Farm, Glen Innes.
White Tartarian	Manager, Experiment Farm, Glen Innes.
Grasses :—	
Paspalum	Manager, Experiment Farm, Lismore.
Elephant Grass (roots and cuttings)	Principal, Hawkesbury A. College, Richmond.
	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Yanco.
Kikuyu Grass (roots)	Principal, Hawkesbury A. College, Richmond
Clovers :—	
Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
Bokhara Clover or Sweet Clover	A. Sommerlad, Hillcrest, Tenterfield.
Canary Seed :—	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Condobolin.

It is especially desired at the present time to locate reliable sources of seed of Thew, Huguenot, Firbank, and Florence wheats, Sunrise, Ruakura, and Guyra oats, and Cape and Skinless barleys, the demand for seed of which for coastal green fodder far exceeds the visible supply.

In addition to those tabulated a number of crops were inspected and passed for purity, but as the growers failed to forward samples their seed has not been listed.

A TREATMENT FOR TOMATO WILT ON TRIAL.

IT having been claimed that successful results had been obtained from a certain treatment of tomato plants affected with wilt, tests of the treatment in question were recently carried out by me on behalf of the Department. Thirty-one plants were included in the experiment, twenty-eight being treated and three untreated. The soil was watered with a solution of ammonia (strong ammonia one tablespoonful, water 1½ gallons) five times a week, and the plants were sprayed with a solution of saltpetre six days a week. The saltpetre solution was made up by dissolving a piece the size of a walnut in one gallon of water and using this as a stock solution, one tablespoonful of it being added to 1½ gallons of water for use. The treatment was carried out for two weeks. At the end of that period I examined the plants and made the following report:—

"There was no perceptible control of the disease in any of the plants treated as compared with the untreated plants. This method, even if successful, would not be applicable to field crops, as the time involved in the work and the cost of material would be too great. Even the most enthusiastic suburban gardener would hardly find time to pay such attention to his plants. The cost for ammonia for a fortnight's treatment for twenty-eight plants was 4s., 4 lb. being used at 1s. per lb.

"If, as recommended, the treatment were to be continued until the disease disappears, the cost, basing it on the experiment carried out, would greatly exceed the price at which tomatoes could be purchased in the shops.

"I might again mention that there was no perceptible control of the disease in any of the plants treated, as compared with the untreated plants."
—W. A. BIRMINGHAM, Assistant Biologist.

Poultry Notes.

MARCH.

JAMES HADLINGTON, Poultry Expert.

DURING the next four months it will be a profitable experience for the novice poultry-farmer to observe closely the incidence of prices of eggs and production. It is customary to hear poultry-farmers discuss winter egg-production as their objective, whereas it is autumn egg-production that is the more valuable. It is during March, April, and May that the highest average prices are obtained for eggs, and only in occasional years is the price of eggs in June equal to that of the preceding three months. Last year was one of these exceptions. The average monthly price for eggs during the three months specially under notice were:—March, 2s. 6·6d.; April, 2s. 9·9d.; May, 3s. 1·1d. The average for the three months was thus 2s. 10d. per dozen, while the average for the following three months (June, July, and August) was 2s. 6·2d. The latter figure was probably higher than would have been the case but for the festivities in connection with the visit of the Prince of Wales. At any rate it was materially higher relatively to the previous three months; and taking into account higher prices right through the year, it was also relatively higher than the averages for the same months in previous years.

The highest price, however, is invariably reached in May—thus demonstrating that autumn egg-production should be the poultry-farmers' main objective; but not alone for the autumn, of course, because if a good autumn laying is obtained it invariably follows that a good average winter laying is assured. Our aim thus becomes autumn and winter egg-production, with the first as our special objective.

How to reach it.

As was shown in last month's notes, high egg-production is not to be expected from hens during the moulting season. It follows, then, that it is to the pullets that we must look for the bulk of our production in autumn. Once this is realised we are in possession of the key to the situation, and it is upon our early-hatched pullets that we are absolutely dependent to pull us through this period of low average egg-production.

In discussing this very vital problem, we have to realise that, while the early-hatched pullets will, if well tended, invariably come on to lay at between five and six months old, particularly so with light breeds, such as Leghorns, a noticeable feature with the later-hatched birds is their slower development, and consequently their later laying. Right now is the time for the poultry-farmer to observe these facts, and to mark carefully the performances of the pullets hatched in the different months.

An Illustration.

As bearing upon the subject, the writer has just completed an inspection of thirty farms, whose equipment and management is well above the average of poultry farms in this State. The progressive development of the young stock, as hatched month by month from June to September, was found to be well up to reasonable expectations; the actual prospective layers for the next two months were June-July hatched birds, while the prospects covering the next four months were these, together with those hatched in August. The expectations for fully 50 per cent. were that they would not come on to lay until June or July. Thus it will be seen that while many of the early-hatched pullets are already laying, and the balance coming up to that point, the expectations for the later-hatched pullets are that they will be much older than six months before they make a start. This is where the lesson has to be learnt.

It is, of course, understood that there are exceptions, and that many later pullets will have developed sufficiently to start laying during the months when eggs are dear; but it is equally certain that the bulk of them will not do so.

This is, perhaps, the best illustration obtainable of how much our success in poultry-farming is dependent upon early-hatched pullets, even after making every allowance for the very early pullets that may go into a partial moult in the winter. It may be remarked that pullets starting to lay in January are almost sure to do this, but let us not forget their performances during the autumn as constituting more than a set-off to the few weeks' rest which they usually take when prices are beginning to decline.

Preparation for Next Breeding Season.

Having examined the incidence of last rearing season and its results, let us now turn to the preparation for next breeding season. Making up the breeding-pens, and all that pertains thereto, should now receive attention. March is not too early to make a plan of operations of all we intend to aim at in the coming rearing season.

Breeding stock may have to be obtained, and by getting this together early an advantage is gained as far as pullets and cockerels are concerned, and a much better selection can be made than if it is deferred until all the forward stock has been picked over. Many farmers do this, and then find nothing but immature stock to select from. These are the experiences that cause a prejudice against breeding from pullets and cockerels. Naturally if immature stock is used for breeding purposes, weakness in the progeny will result, but the fact should not preclude the use of well-developed young stock as breeders. Not only so, but the farmer that relies solely upon second-year birds for breeders is almost certain to find himself with too few early-hatched and too many late-hatched chickens. As a guide to those who might be in doubt about using pullets and

cockerels as breeders, it might be laid down that, taking light and heavy breeds separately, and other conditions being right, the following ages and weights should be suitable to breed from :—

(a) Light breeds.—Cockerels, 9 to 10 months of age, 5 lb. weight and over. Pullets, same age, $3\frac{3}{4}$ lb. weight and over.

(b) Heavy breeds.—Cockerels, 10 months of age, 7 lb. weight and over.

It follows, of course, that the exercise of judgment on the part of the farmer is necessary, and that it is difficult to lay down hard and fast rules in regard to these ages and weights. For instance, sometimes a fairly large and well developed bird, as far as frame is concerned, may from some cause lose some weight. This might happen when a bird is taken from a flock and confined in a coop for a few days, or when it has been running with a large flock under harassing conditions; such birds might be considerably under the weight, while the frame and physique would indicate otherwise. The weights given are set down for birds of normal condition.

Weights and ages are, of course, not the only consideration in selecting breeding stock. Type, colour, and any defects or desirable points will need to be taken into consideration. Obviously, these cannot be fully dealt with in these notes, and the breeder is referred to the standards for the particular breed he is keeping. These are given, together with illustrations, in "Poultry Farming in New South Wales," which is obtainable from the Government Printer, Sydney, price 1s. 2d., by post, or from booksellers.

The Moulting Season.

The moulting season proper extends from January to May. Many of the birds will commence to moult a month or more earlier or later but March might be regarded as the middle of the moulting period, and the time when the maximum number will be in the worst condition.

Moulting is a natural process, and when birds are in normal, healthy condition this period should cause the poultry-farmer no concern beyond the fact that only a small number of the hens continue to lay while changing their coat of feathers. Nevertheless, a little extra care and attention to the birds at this, as at any other time, will well repay the farmer. Good, appetizing food, careful feeding in regard to amounts given, a plentiful (but not over) supply of green food of good quality, or in fact whatever makes for a healthy condition, will assist the birds to get through the moult with the least disturbance of their general health.

Fanciers and show breeders often resort to all sorts of methods and to the use of different nostrums in feeding with the idea of forcing birds through the moult, in order to bring them into show condition early, but it must be acknowledged they do so with very little success. Birds possessing stamina and good physique will come through the moult all right, and the idea that birds can be forced through the moult is more imaginative than real.

However, moulting birds on many farms leave much to be desired, in that they have not, apart from the condition of feather, that appearance which is

the sign of good health. In such cases there is nothing better than a course of iron tonics, together with sufficient Epsom salts to act as an alternative when required. A course of Douglas mixture can be recommended in such cases.

How to make Douglas Mixture.

How to make and use this mixture is not as well understood as it should be. The formula has previously been published in these notes, but new readers and the above facts constitute a necessity for again reproducing it. The method of making and using it is as follows:—Take 4 oz. of sulphate of iron and 4 oz. Epsom salts; dissolve in 1 gallon of boiling water; let it cool, then add half an oz. of what is sold by the chemist as dilute sulphuric acid.

This is "stock" or concentrated mixture, *which must not be given to the birds in this form.* Bottle the mixture in stone or glass (*not metal*) vessel, label it poison, and put it away. Two tablespoonsful of this mixture added to each gallon of drinking water on three to five days per week over a period of three or four weeks will be found one of the best poultry tonics known. It is cheap and easily made. The quantity advised is practically harmless to ordinary iron or galvanised drinking vessels, buckets, &c.

Care is necessary in using sulphuric acid so as not to get it on the skin, which it will burn severely, and a glass stoppered bottle is necessary to contain it.

Extermination of Red Mite.

Experiments with various mixtures likely to control red mite have been proceeding concurrently as opportunity offered at Hawkesbury Agricultural College, and at Grantham Stud Poultry Farm, in the use of miscible red oils, such as are used for spraying fruit trees (but not miscible disinfectants) in place of kerosene emulsion for spraying purposes. These have been found effective with a 15 to 20 per cent. solution. They are not cheaper than kerosene emulsion, but they are simpler to mix, and to those who find making kerosene emulsion difficult (although it should not be so) these oils will be found effective. They are, however, found to injure painted surfaces, and are therefore only recommended as sprays on unpainted wood.

To Destroy Mound Ants.

There are two simple methods of dealing with mound ants. The first is to dissolve two ounces of cyanide of potassium in half gallon of water and to pour a small quantity down the openings of the nests in the evening, when they are usually inhabited. The second method is to pour in bisulphide of carbon, employing about two tablespoonsful of this volatile and inflammable liquid for each main opening into the nest. If the openings are then tamped down with clay the fumes are sufficient to kill the ants, but the fumes may be fired and the underground chambers of the nest thereby shattered by throwing a wet bag over the opening of the nest after the bisulphide has been poured in, then removing the bag after a couple of minutes (when the fumes are rising) and applying a light at the end of a stick.—W. W. Froggatt, Government Entomologist.

Orchard Notes.

MARCH.

W. J. ALLEN and S. A. HOGG.

In orchards in the drier districts of the State, it will be found an advantage to plough the land as soon as possible, providing, of course, that all the fruit has been removed from the trees, and that there will be no unnecessary traffic in the orchard. It has been found advisable to leave the land in a rough state for the purpose of thoroughly ærating the soil, checking the moisture, and retaining the winter rains. In orchards that are subject to washaways, provision should always be made by either permanent drains or temporary furrows. In the case of citrus orchards, provision should be made throughout the winter to carry off superfluous rain water. The lack of drainage in many of our citrus orchards seems to be the cause of the trees becoming weak and sickly, thereby encouraging the attacks of fungus growths and other diseases.

Grading and Packing of Apples and Pears.

There is a particularly heavy crop of apples and pears throughout our main tableland and highland districts. It is very necessary that growers should have their fruit packed in a uniform manner, and, for that purpose, the diagonal system of packing should be adopted.

The chief points in grading apples are: Size, colour, freedom from disease, and uniformity through every case.

The market generally demands a good, clean, medium sized fruit, $2\frac{1}{2}$ inches being about the ideal, as the buyer generally wants what to the trade is known as "a good count." Extra large fruit are not desirable, as these are generally coarse and do not keep so well. When grading, any fruit which shows the slightest sign of disease should certainly be thrown out.

It is impossible to over-estimate the importance of grading apples for market. It is a thing which cannot be overdone. Most fruit is practically unsaleable without grading, and the better the grading the better it sells.

Every grower's pack should be as good as his bond; there should be no topping up, nor filling up corners with small apples. It will be found necessary in many cases to hand-grade apples after they have passed through the machines. No matter how perfect the machine may be, it can only discriminate in size, and blemished apples will, of course, be graded accordingly. Since the advent of arsenate of lead as a preventive against the attacks of codlin moth, growers have to a great extent been able to check the depredations of this pest. Although it has been found that it kills a very large percentage of the larvæ, the latter, in many instances, before dying have sufficient energy to enter the fruit, getting perhaps just under the skin, and thereby

leaving a blemish that is generally called a sting. Any apples so "stung" must be regarded as blemished, and care should be taken to avoid mixing them with sound fruit.

Wrapping.

Wrapping paper this season is very expensive, and it may, perhaps, be dispensed with for local markets, but should be used on fruit for export.

Whether apples should be wrapped or not depends somewhat on the variety and the grade of fruit.

Wrapping has several advantages:—

1. It serves as a cushion in the case of delicate fruit.
2. It prevents rot and fungoid diseases from spreading from one fruit to another.
3. It maintains a more even temperature in the fruit.
4. The fruit has a somewhat more finished appearance when exposed for sale.
5. Wrappers keep the fruit firm and snug in the packages.

The disadvantages of wrapping may be summarised thus:—(1) It adds to the cost of packing; (2) it prevents rapid cooling in cases where the fruit is not cool at the time of packing.

Harvesting.

This work will now be engaging the time of growers of deciduous fruits and grapes. Raisin grapes and sultanas may be picked and dried. Late table grapes will be coming to market from the cooler districts.

Prune drying will be in full swing—early ripening prunes, having been dried and put through their first process, will need very careful attention just at this time. As the early ripening fruit does not contain a large percentage of sugar, it is apt to go mouldy, and it will, therefore, be necessary to examine it from time to time before giving the final dipping.

All good keeping varieties of apples and pears may be forwarded to the cool stores for later markets, if prices are not satisfactory. Granny Smith apples and Winter Cole and Winter Nelis pears are suitable for this purpose.

Fruit Fly and Codling Moth.

It seems almost incredible that any fruitgrower who is alive to his own interests would allow either fly or moth infested fruit to lie on the ground until the grubs have left them, but it does happen, and far too frequently. It is to these careless growers that we are usually indebted for the breeding and spreading of many of our pests, and it is they too who give so much extra trouble to inspectors under the Fruit Pests Act.

Small flat tins or saucers suspended on the sunny side of the tree, and containing a small quantity of kerosene, serve as a splendid trap for the adult fruit flies on the wing. By adopting this practice, growers will place themselves in the position of minimising the source of infection. To secure the best results by this method, every citrus grower should set traps as suggested. The poisoned pollard bait has also given excellent results.

Budding.

It is rather late, but, if the month should prove a warm one, it is quite possible that buds will still take if inserted in deciduous trees that are not producing either good fruits or satisfactory crops. Nursery stock may still be budded. The buds that are inserted so late in the season will remain dormant, and are known as "dormant buds." This explanation is necessary to the beginner in order that he may distinguish the difference between a dormant bud and one with one season's growth. It is sometimes preferable to plant trees with dormant buds rather than lose a season, providing one-year-old trees cannot be obtained from the nursery.

Preparing Land for Planting.

Clearing, grubbing, ploughing, and subsoiling preparatory to planting should now be carried out as soon as possible, and those who intend planting this coming winter and who have not completed these operations, should lose no time in finishing this work, so that new land will have a little time to sweeten before the young trees are set out, as well as to enable the orchardist to complete all planting operations early in the winter.

Provided the ground is in well worked condition and contains ample moisture, young citrus trees may be planted this month in the coastal districts.

Vineyard Notes for March.

Wine-making will be in full swing this month, and most of the grapes will have been picked before it ends. When once the crop has been gathered, it has become a custom with most growers to regard the vineyard work as being at an end until the start of the pruning and ploughing. This should not be the case, as the keeping of the ground free from weeds, such as hogweed, summer grass, &c., will not only facilitate future ploughing operations but will also conserve soil moisture. It will be noticed that badly cultivated vineyards lose their leaves early, which is detrimental to best results as regards wood maturity. To keep a vine in a healthy condition as far into the season as possible should be aimed at. It may be mentioned, too, that spraying for downy mildew should not be neglected if weather conditions are such as still favour its development.—H. L. Manuel.

To Deal with Sparrows.

The following mixture has been used with success by the Departments of Agriculture here and in South Australia for poisoning sparrows and similar pests :—

Mix one tablespoonful of strychnine and one of washing soda with three parts of water and a little sugar. Boil until all ingredients are dissolved, then mix with 10 to 12 lb. of wheat. The grain so poisoned can be distributed in small tins about the homestead or nailed to beams in sheds or high posts. Better results are obtained by using the poisoned grain intermittently and by baiting with good grain for a few days before poisoning; when the birds have been attracted to the spot lay the poisoned wheat.—W. W. Froggatt, Government Entomologist.

Agricultural Bureau of New South Wales.

SUGGESTED SUBJECTS FOR BUREAU MEETINGS.

It sometimes happens that, owing to some inadvertence, members of branches meet without having any particular subject before them. In such a case one of the following paragraphs may provoke a useful discussion, and a brief report of the discussion will often interest other branches.

What method do you adopt of preparing the seed-bed for wheat, oats or barley, (a) on fallowed land, (b) on stubble land?

Do you make any effort to ensure a supply of succulent green feed for the ewes and lambs in the winter—a time when such feed has a special value in its maintenance of the milk flow?

Have you ever sown cover crops of winter feed on maize land after an early crop is off? What effect have you noticed these crops (be they wheat, oats, rye, field peas, rape, vetches, or anything else) to have on the subsequent crop?

What has been the most prevalent plant disease with which you have had to contend this summer? What steps did you take for its control and with what results? Could the outbreak have been reasonably anticipated and its effects minimised?

What experience had you with Bordeaux mixture this season? Has it damaged the foliage of fruit trees, and what strengths of the mixture did you use?

Modern civilisation is said to be largely a matter of communication: What steps could be taken in your district to improve communication, (a) by improvement of the roads, (b) by co-operation to reduce freights?

THE FIRST DISTRICT CONFERENCE.

The honour of holding the first District Conference in connection with the Agricultural Bureau belongs to the branches around Orange. It took place on 10th February, fourteen delegates attending from the following branches:—March, Messrs. F. J. and W. Griffith; Springside, Messrs. T. C. Bowen, J. A. Thompson, and Scarr; Garra-Pinecliff, Messrs. S. W. Packham and W. Forrester; Coradgery, Messrs. W. E. Tayler and J. Clatworthy; Borenore, Messrs. P. Henderson, W. Lewis, and T. Millgate.

Mr. C. C. Crane, Organising Inspector, Mr. Tonking, Agricultural Master at Orange High School, and Mr. T. Hindmarsh, Lecturer on Agriculture at the Teachers' College, also attended.

Mr. W. E. Tayler was elected Chairman, and Mr. G. Henderson Secretary.

The proceedings were marked by enthusiasm and a conviction of the utility of the movement, and by a desire to forward the interests of the Bureau and the propaganda of the Department.

A number of resolutions were passed, among which were the following:—

That it is desirable that the Agricultural Department provide Inspectors of Agriculture for every shire in the Central and Eastern Divisions to permanently reside in the most central town of each shire, so that farmers can avail themselves of his advice and guidance whenever needed, and that the title "inspector" be altered to "instructor."

That this Conference urges the necessity for starting a Bureau news publication, giving full reports of the work of the various branches of the Bureau.

That the Department be asked to arrange for more experimental plots to be carried out under the auspices of the various branches of the Bureau.

That this conference expresses its sympathy with pastoralists in exterminating wild dogs, and urges the Government to give them all assistance possible.

That a thorough investigation with reference to the feeding-off of Sudan grass be made to ascertain if it is injurious to stock at any period of its growth, and that circulars be sent out to all branches with the report.

That this conference expresses its appreciation of the Department of Agriculture's work and help to farmers.

REPORTS AND NOTICES FROM BRANCHES.

NOTE.—While gladly publishing in these columns the views of members of the various Branches of the Agricultural Bureau, the Department does not necessarily endorse the opinions expressed.

Adamstown.

A branch of the Bureau has been formed at Adamstown, in the Newcastle district, and at the inaugural meeting the following officers were elected for the ensuing year:—Chairman, Mr. G. Brock; Treasurer, Mr. B. Court; Hon. Secretary, Mr. F. T. Lewis; Assistant Secretary, Mr. R. Farley.

There has been a distinct development near Adamstown in recent years in the production of fruit, vegetables, and flowers, and the new branch is regarded locally as having every prospect of a useful career.

Auburn.

At a meeting on 12th February, Mr. R. M. Finch read a paper on chrysanthemum culture for show purposes.

Too much stress could not be laid on the preparation of the plants for cuttings, for the foundation should be well laid. Selection of site, propagation, planting, and so forth were all dealt with. The selection of the buds was most important, and the habits of individual varieties would have to be studied in this regard, some doing best on what was known as first crown, and others on terminal buds. Timing the buds for show purposes could only be learnt by experience, but if any bud, either second crown or terminal, was selected during February the flowers would be ready in April. Deformed buds were generally caused by unripe wood, the ground not having been firm enough in the first place. The qualities necessary for a perfect bloom for show were depth, size, solidity, breadth of petals, finish, freshness, and colour.

A good show of flowers, vegetables, and fruit (comprising grapes, figs, and quinces) was staged, and much admired. The vegetable display is improving and increasing each month, and some good exhibits of fruit have come forward, although the schedule does not at present provide for fruit.

Bimbaya.

A meeting was held on 20th January, when Mr. H. Wenholz, B.Sc., Inspector of Agriculture, delivered a lecture on maize culture.

Mr. Wenholz covered the subject from the preparation of the soil to the harvesting of the crop. He advocated the burning of old maize stalks if smut, worms, &c., had given trouble in the previous crop, but ploughing under could be practised if those pests were not troublesome. Many farmers neglected to plough their ground early enough; from 4 to 8 inches of rain generally fell during the winter, and a large percentage of this could be stored in the soil by early and deep ploughing. Fallowing represented an increase from 7 to 10 bushels per acre.

In reply to various questions, Mr. Wenholz said that whether maize stalks should be fed off after the crop would depend on local conditions. The farmer would have the advantage of the manure, but the moulds that grew on the stalks and the smut were not good for stock. Peas or vetches would be a better crop to precede maize than wheat or oats. The yield obtained locally should be double that obtained on the average.

Cordeaux-Goondarin.

At the monthly meeting, on 27th January, the Chairman's resignation was received with expressions of regret, and Mr. J. Murphy was elected to fill the vacancy.

A paper was read by Mr. G. H. Walker, the text of which is as follows:—

A Method of Removing and Transplanting Old Trees.

Having occasion lately to change my place of habitation, I was loth to leave behind me the fruit-trees which had been established there for upwards of seventeen years, some more, some less, but all in good profit and healthy. There was risk in moving them from good ground to new land on a hill-side, with the clay only 15 inches from the surface. General opinion declared it could not be successfully done, and many were the adverse comments made upon this "urban experimental plot"—for, being in the main street, in full view of every passer-by, it did not lack criticism. Now in its second fruiting season the results have fully justified their removal.

The trees, five apples, two pears, two peaches, one apricot, and four Japanese plums, were lightly pruned in July, 1919, and immediately dug—in the following manner:—A circular trench, 4 feet from the base of the tree, was dug to 18 inches deep, and all extending roots cut through; some of these were very large. Then a hole in the earth was made with a crowbar in a slanting direction, commencing 3 feet from the trunk of the tree and driven inwards and downwards until the centre of the tree was reached. A plug or stick of gelignite with fuse and detonating cap was finally rammed in and exploded, the action of this being to loosen and even blow away the earth from the fibrous roots; at the same moment the tree was lifted some 4 or 5 inches upwards, and then settled back on its base with the earth all cleared away. Every tree, with one exception, came out unbruised and unbroken.

The trees were then layered for six weeks, the ground not being ready or fences not erected; the holes were dug and gelignite used to break up the clay, but all that happened was that a circular chamber was made which was filled with earth and animal manure.

The summer of 1919 was exceptionally dry, and the crops did very little good, but the installation of a septic tank altered matters completely, the effluent watering the ground so well that on several trees new blossoms appeared in the autumn, and ripe pears (two Packhams) were picked in August, of good flavour and sweetness. A Triumph peach broke into full spring bloom and carried its crop in a miserable way through the winter. It was strange to see a full crop of peaches on a leafless tree. This tree, now nearly dead, is the only failure of them all. The trees could not be healthier, and the crop this year will be a good medium one.

The successful removal of these trees was due to the effort made to keep their roots intact, and was proved by the resulting crops both in 1919 and 1920.

Dapto.

At a meeting on the 13th January, Mr. R. N. Makin, Inspector of Agriculture, lectured on ways and means of restoring impoverished soils. A summary follows:—

Restoring Impoverished Soils.

After land had been cropped for a number of years it often showed signs of exhaustion, as the supply of available plant-food would not last indefinitely. To remedy this impoverishment, drainage, deep ploughing and manuring might all be considered. Three methods of drainage were applicable to the district, viz., (1) pipe drainage, consisting of 2-inch to 4-inch pipes placed about half an inch apart; this was a rather expensive method; (2) timber, where timber was plentiful, placed 18 inches to 24 inches under the surface, two pieces being so placed as to meet at the top and spread apart at the bottom, with brush and stones on top; (3) stones filled about 6 inches deep in a trench 18 inches to 24 inches deep, and covered with brush, and finally soil; this made a very cheap and effective drain.

In all these methods there was one main channel with several others running into it. When clay was close to the surface, underground drainage was impracticable, and surface drains not more than half a chain apart should be made to prevent washing.

The subject of manuring was also dealt with, and suggestions made for local conditions.

Dural.

On 20th January Mr. W. le Gay Brereton, Assistant Fruit Expert, visited the district and delivered a lecture on the control and eradication of pests. The questions that followed this lecture formed a very interesting feature of the evening, and resulted in useful information being given. Several members testified to the great help these lectures had been to them.

On 28th January another meeting was held, when miscellaneous business was dealt with.

Glenorie.

This branch met on 29th January, when Mr. E. King was elected Chairman, and Mr. H. Walker Vice-chairman. Formal business was transacted.

Granville.

A branch of the Bureau has been formed at this centre, and at a meeting on 15th December the following office-bearers were elected:—Chairman: Mr. G. Midgley; Vice-chairmen: Messrs. J. B. Brown, H. Oliver, and C. E. Small; Hon. Secretary: Mr. B. Hyslop. The subscription was fixed at 2s. 6d. per annum, or 3s. 6d. for two members in one family.

At the first committee meeting on 6th January arrangements were made for monthly competitions throughout the year, and also for special competitions on the same nights, classes being arranged for flowers, fruit, and vegetables. The first of these competitions was held on 15th January, when keen interest was taken in the exhibits. On the same occasion a paper was read by Mr. B. Hyslop on carnation growing. The autumn show of the branch is to be held on 9th April.

Inverell.

At the January meeting of this branch, the proposal of the Department that a separate leaflet should be issued monthly, in which the reports of the branches of the Bureau should be published, was considered, together with the Department's request that branches should indicate whether they could supply a fair quantity of suitable news and other matter for the purpose.

The proposal was heartily approved by the branch, and support was promised.

Lower Portland.

A meeting was held on 12th January, when a discussion took place on fungus troubles of fruit trees, and also on marketing problems. The orchardists of the district, it was said, were not having a profitable time owing to the very low prices realised for their stone fruit, and some were much disposed to replace the trees with citrus trees. The prevalence of fungus diseases was associated by all with the very wet weather early in December.

With regard to marketing, members were of opinion that a different system was wanted. At present 2s. per half case and 2s. 6d. per bushel case were expended before the grower got anything.

Mannus.

At a meeting on 4th February, Mr. S. H. Todd was elected Hon. Secretary, vice Mr. Simple, resigned. A useful discussion ensued on St. John's wort, and the general feeling of the meeting was dismay at the rapid spread of the weed, and the hope was expressed that the Government would take steps to aid in its destruction in the near future.

March.

A meeting of this branch was held on 9th February, when a paper was read by Mr. R. Parker, on dry farming, from which the following paragraphs are taken:—

DRY FARMING.

The term "dry farming" seems to have come from America. The probability is that it was first employed by those whose lands were above the level of irrigation. At the present time the general application is to farming in districts with a comparatively scanty rainfall, without the aid of irrigation. One of the most successful of the Australian States in the practice of dry farming is South Australia, where in the Mallee country, with a rainfall of 12 to 16 inches, good crops have been produced. During the past ten to fifteen years, the wheat belt in our own State has been greatly extended, owing to our knowledge of dry farming methods.

The general practices followed are:—(1) Fallowing the land; (2) working the fallow; (3) growing fodder crops.

The essential feature of fallowing is ploughing, and this should be well done, as on this depends much of the success of the method. The time for ploughing will differ in different districts, but the general rule is to get it done before the hot dry weather sets in. The drier the district, the earlier the ploughing should be completed. Moreover, the ploughed land is better for the work of soil bacteria, which have been proved necessary to plant growth.

The fallow should be worked after each shower to keep the surface loose and prevent losses of moisture by evaporation and running off.

Fodder crops can be grown in winter and fed off in early spring, and the land then ploughed for the fallow. It thus receives the benefit of the animal manure, as well as the residue and roots of the crop.

To understand the reason for the foregoing operations, it is necessary to say something on soil moisture. Everybody knows that after rain, the surface always cakes, and in stiff soils it becomes so hard as to be almost unbreakable. Now in the earth there are millions of small tubes, called capillary tubes, ascending from the subsoil to the surface. Once the surface cakes, these tubes become connected with the atmosphere, and through them moisture escapes. By breaking the surface, the tubes also are closed up, and the moisture is kept below for the benefit of the roots of plants.

As a result of working the fallow, the soil conditions at the time of sowing should be ideal—the land should have a fine tilth, and be free from weeds.

Another matter in connection with soil moisture is the presence of humus. Lands that contain humus are more capable of retaining moisture than those which do not. Humus has the power of absorbing moisture, but in dry climates it becomes rapidly exhausted, owing to being burnt by the heat; therefore it requires renewing more often than in moister localities.

Milton.

On 16th January, Mr. S. A. Hogg, Assistant Fruit Expert, delivered a lecture on fruit culture. He described planting methods carefully, and advocated the use of apples and pears in the district, mentioning Jonathan, King David, Rome Beauty, Granny Smith, and Yates as the most suitable varieties. Of pears, he recommended Williams, Packham's Triumph, and Josephine. Stone fruits could be grown for home consumption, but not for competition with the true peach-growing districts.

A meeting was held on 18th January, when Mr. A. Warden and Mr. E. Breakwell, B.A., B.Sc., Agrostologist, took up the subject of the improvement of the pasture lands of the district.

Mr. WARDEN said that the continuous feeding for years on pastures had taken nutriment out of the soil and had given nothing back; hence the land had deteriorated and the soil had become exhausted. This was primarily because of the depletion of the humus, and it would have to be restored before good results could be expected. This could be done by green manuring, cowpeas and other legumes being particularly suitable for the purpose. Maize might be sown in drills, and after the third scuffling seed of crimson clover could be sown, and then when the maize had been cut for silage the clover and stubble should be ploughed in. Attention should also be given to drainage and to rotation of crops. The small area under cultivation in the district was much to be deplored, as it made the improvement of the land much more difficult.

Mr. BREAKWELL said he noticed a great spread of paspalum in the district since his visit five years ago. There was a complaint that paspalum after five years began to go off, and that on pastures exclusively comprising paspalum the returns showed a steady decrease. It seemed that the physical properties of the soil needed changing. To bring about this change he recommended the practice of the North Coast farmers of ploughing it with a mouldboard plough, set shallow so that the plough would just skim the surface. This should be followed by cross-discing. If this were done in the autumn, and a winter crop were sown, it would be possible to sow a crop like maize in the spring, after which the soil could be allowed to revert to paspalum or sown with some other crop. To supply the soil with humus he recommended a mixed crop—a drought-resistant grass, like Sudan grass (sown in drills), and cowpeas. This made a perfectly balanced ration, and if fed off during the hot months could be ploughed under in the autumn and the soil would be considerably improved. Bokhara clover was a good rotation crop and should do remarkably well in this district. It should, however, be kept closely fed to get the best results.

Another grass strongly recommended was Toowoomba canary grass (*Phalaris bulbosa*). This was a most succulent grass which gave splendid results. It would be advisable for farmers to get a few pounds of seed and try it on a small scale.

Shearman's clover, a hybrid clover which had to be grown from roots, was strongly to be recommended for damp soils, provided the soil was good. This grass was quite a new thing, and was giving excellent results. Cows could only be left on it for a short time, however, as there was a tendency for them to become blown.

Kikuyu grass, a Kaffir grass, was also mentioned as giving excellent results. Elephant grass was a good standby, but was apt to be coarse, and should be kept cut about two feet from the ground. He recommended, however, that the farms should be divided into many paddocks, and that the cows be subjected to frequent change of pastures. There would then, without doubt, be a considerable improvement in both the quality and the quantity of the milk yield.

He was surprised at the careless way summer crops were sown. Even for ensilage much better results could be obtained if the crops were set in drills and kept free from weeds, instead of being broadcasted. He noticed, too, an absence of any attempt to conserve fodder. During the recent drought many farmers had lost cattle, while other districts such as the Tilba Tilba, though similarly affected, were provided with silos and had saved their herds.

Finally, Mr. Breakwell suggested a pastures competition, to be judged annually about show time, points to be awarded on the following scale:—Variety of grasses, 30 points; legumes, 15 points; freedom from weeds, 25 points; freedom from disease, 10 points; fertilising and rotation, 10 points; judicious stocking, 10 points; total, 100 points.

Pambula.

This branch met on 20th January, when Mr. J. A. Martin read a paper on the maize plots located in the district. He said it had been clearly demonstrated during the thirteen years that experiments had been conducted near Pambula that fertilisers were highly beneficial; in some cases the increase had been as much as 20 bushels per acre, and on rich alluvial flats good results had generally been given by the P 5 mixture, but in the present trials where 2 cwt. superphosphate was used, the return was, perhaps, most economical. The following varieties had generally given high yields:—Red Hogan, Improved Yellow Dent, Silvermine, Boone County, and Funk's Yellow Dent. The only objection to Red Hogan was that it contained a high percentage of moisture, which soon dried out leaving the grain light. Hickory King was not suitable for flat lands. Of the newer varieties, U.S. 133 stood out alone, being very early and infinitely superior to the flint type. Several members who had tried the last-named variety this season testified to good results from it.

Penrose-Kareela.

The monthly meeting was held on the 8th February, when arrangements were forwarded for exhibits in connection with "Country Production Week," Moss Vale, and R.A.S. Shows.

Springside.

This branch devoted its last meeting to the discussion of the proposals put forward by the Agriculture Section of the Royal Society. Many of the suggestions were approved of, but in other cases amendments were adopted. The meeting was a useful one, a variety of subjects being debated.

Stoker's Siding.

A branch of the Bureau has been formed at this centre, the following being the office-bearers: Chairman, Mr. R. Maxwell; Vice-chairman, Mr. C. Cox: Treasurer, Mr. H. E. Byrnes; Hon. Secretary, Mr. W. E. Richens. The subscription was fixed at 3s.

Stratford.

This branch met on 24th January, when the arrangements for an exhibit from the district at the Gloucester show were advanced.

A herd-testing association has been formed in this district, consisting of the dairymen of Stratford and Gloucester.

A paper was read by Mr. T. Germon on land settlement and rural finance. He attached great importance to roading as a factor in the development of settlement, and advocated that settlers should receive monetary assistance for such improvements as ring-barking, fencing, scrub-felling, &c.,—say fifty per cent. That would enable the settler to meet his second year's work, such as suckering and grubbing, and from that time onward he should receive some return for his labour. The residence conditions should be relaxed, too, to allow the settier to take more work off his block.

Warrah Creek.

The monthly meeting was held on 20th January, when a number of matters were discussed. The branch has already done useful work in procuring a local recreation ground and improving it, and the erection of a public hall is now under consideration. A sports meeting is to be held at Easter, the proceeds from which will be devoted to some local cause.

Wellington.

On 18th January Mr. S. A. Hogg, Assistant Fruit Expert, gave a lecture on summer thinning at Mr. M. Bembrick's orchard. It proved too late to do any thinning, the middle of December being the proper time, but the methods were outlined and valuable information was given. It had been found advisable, he said, not to top any trees at this time of the year, unless the trees were not evenly balanced, when the top shoot or shoots were nipped off, the exception being the case of some Japanese plums which made excessive growth in the season. The main thing in summer thinning was to keep the centre of the tree well open, also the sides should be fairly open, to admit plenty of direct light and air. If the tree was too crowded, the tendency in many trees was for the fruit-bearing wood to go to the top of the tree, or the outside, and the result was the interior and bottom of the tree soon became denuded of fruit.

In the evening, Mr. Hogg lectured on fruit preserving and jam making. The treatment of various fruits was outlined and the many ladies who were present, as well as gentlemen, profited by the suggestions made.

Wentworthville.

On 19th January, Mr. W. Bennett delivered a lecture on the electrical treatment of seeds.

Mr. Bennett had himself experimented with seeds and had had some interesting results. White turnips took sixty days to mature, but by treating the seed and vitalising the germ with a slight electric current the process was hurried and the turnip was ready for the table in thirty-five days. The same applied to practically every vegetable grown, the time limit being almost cut in halves, a more succulent vegetable being the result of the quick growth.

The apparatus used was merely a small medical coil, similar to that used for the treatment of nervous disorders in people. He found that the seed must be well soaked in order that it may receive the current. Many agents had been tried, but the best results had been obtained from a weak solution of nitrate of ammonia ; nitrate of soda was also used without damage to the plant. Some of the greatest successes, however, were achieved with seed soaked in pure water. The method of applying the current was shown to the audience, the soaked seed being placed in a thin layer on a zinc plate to which one electrode had been connected, the other electrode being passed over the seed with a stroking movement. Seed sown immediately after treatment was found to give the best results, but if kept for a time the seed must be properly dried. It had to be remembered that quick growing vegetables required a plentiful supply of water.

A number of photographs showing the wonderful root systems developed by plants grown from electrified seeds were also exhibited.

Departmental Note.—Much work has been done in England and Europe in this sphere and the consensus of opinion at present is that any good results obtained have been due rather to the soaking of the seed than to the electrical treatment. Dr. Russell, of the Rothamsted Experiment Station, states that the Wolfryn treatment (which closely resembles Mr. Bennett's method) lacks certainty. It might be pointed out that in carrying out a test of this kind, the controls (or plots grown for comparison) should be sown with seed that has been soaked just as has been the electrified seed, so that the only difference in treatment should be the electrification and nothing else. Comparative plots sown with seed absolutely untreated would not truly test the results of electrification.

Windsor.

On 14th December, Mr. J. N. Whittet, Assistant Agrostologist, delivered a lecture on seeds and seed-testing.

Mr. Whittet pointed out the paramount importance of the subject to farmers, covering not only quality, but purity. It was necessary to estimate, before planting, the percentage of seeds that would germinate, and also the number of weed seeds present. At the same time the general appearance of the seed should be closely observed, and if not of a bright appearance, it could invariably be classed as old seed. If seed smelt musty, or if insects such as weevil or grain moth were present, it should be discarded, because good results could not be expected from such seed. Good quality seed would produce strong seedlings, which would be able to stand a fair amount of dry weather, as strong seedlings would make a good rooting system, and thus would be able to collect moisture and plant food from a large area of soil. Some account was given of the seed-testing work done by the Department, and of how it acted on behalf of the Federal quarantine officials in connection with imported parcels of seeds. Rapid and even germination, as well as freedom from weed seeds, was of importance to the farmer, who therefore had a peculiar interest in the work of seed-testing.

Woonona.

At the December meeting Mr. R. Hunter gave a valuable lecture on the soil, carrying out many interesting demonstrations in the presence of his hearers. Illustrating his remarks freely with blackboard sketches and practical experiments, he dealt with his subject under the following headings :—(1) The soil, what it is ; (2) how it is made ; (3) chief kinds of soil and how to improve them ; (4) dwellers in the soil ; (5) what it does for the tiller.

The annual show of the branch was held on 10th and 11th January, the event being more successful than any yet held. Poultry, fruit, vegetables, and flowers were all entered by a goodly number of competitors, the fruit and

vegetables providing some particularly keen competitions. A special feature was the section showing specimens of plants grown by different manures and different methods.

On 8th February there was a large attendance, when business connected with the autumn flower show was transacted.

This branch is again to the fore in the purchase for members of fruit trees, fowl wheat, manures, etc., and it also holds spring and autumn flower shows, and a two-days and nights general show. With its 163 members, and a balance of £71 14s., it asks "Can you beat it?"

Yarramalong.

The branch met on 19th January, when general business connected with roading and postal matters were dealt with. The staging of an exhibit at the local show also occupied attention.

On 9th February another meeting took place, at which a good deal of general business was transacted. The attention of the Department of Agriculture was directed to a large flying-fox camp at Dooralong, and assistance asked in its destruction. Owing to the removal of Mr. E. Hodges from the district, Mr. A. A. Appeldorff was elected Hon. Secretary.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1921.

Society.	Secretary.	Date.
Mudgee A., P., H., and I. Association	E. J. Hannan	Mar. 8, 9, 10
Glen Innes P. and A. Society	Geo. A. Priest	,, 8, 9, 10
Moruya A. and P. Society	H. P. Jeffery	,, 9, 10
Tumbarumba and Upper Murray P. and A. Society	E. C. Cunningham	,, 9, 10
Gloucester P., A., and H. Society	F. H. Chester	,, 10, 11
Cooma P. and A. Association	C. J. Walmsley	,, 10, 11
Goulburn A., P., and H. Society	F. D. Hay	,, 10, 11, 12
Batlow A. Society	C. S. Gregory	,, 15, 16
Nimmitabel A. and P. Association	O. E. Silk	,, 15, 16
Armidale and New England P., A., and H. Assocn.	A. H. McArthur	,, 15 to 18
Cumnock P., A., and H. Association	K. J. Abernethy	,, 16
Upper Hunter P. and A. Association	R. C. Sawkins	,, 16, 17
Gundagai P. and A. Society	H. W. Simpson	,, 16, 17
Macleay A., H., and I. Association (Kempsey)	E. Weeks	,, 16, 17, 18
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 21 to 30
Queanbeyan P. and A. Association	J. G. Harris	,, 23, 24
Coonabarabran P. & A. Association	Geo. B. McEwen	April 7, 8
Upper Manning A. and H. Association (Wingham)	D. Stewart	,, 13, 14
Narrabri P., A., and H. Association	C. C. Baker	,, 13, 14, 15
Orange A. and P. Association	G. W. Williams	,, 13, 14, 15
Clarence P. and A. Society (Grafton)	L. C. Lawson	,, 13 to 16
Wellington P., A., and H. Society	A. E. Rotton	,, 19, 20
Hawkesbury District A. Association (Windsor)	H. S. Johnston	May 12, 13, 14
Murrumbidgee P. and A. Association (Wagga)	A. F. D. White	Aug. 23, 24, 25
Corowa P., A., and H. Society	J. D. Fraser	,, 30, 31
Cootamundra A. P. H. & I. Association	C. H. Inson	Sept. 14, 15
Northern A. Association (Singleton)	J. T. McMahon	,, 15, 16, 17
Henty P. and A. Society	H. Wehrman	,, 27, 28
Deniliquin P. and A. Society	P. Fagan	,, 26

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Agricultural Gazette of New South Wales.

Farmers' Experiment Plots.

WHEAT, OAT, AND BARLEY EXPERIMENTS, 1920.

Southern District.

G. C. SPARKS, Inspector of Agriculture.

THE 1920 series of wheat, oat, and barley experiments were located as under:—

R. H. Thackeray, "Woornack," Young.
E. W. L Gordon, "Yanterilla," Tubbul.
H. M. Hall and Sons, "Studbrook," Cunningar.
Jennings Bros., "Urunga," Culcairn.
Eulenstein Bros., "Back Creek," Henty.
T. E Kendall, "Mayburn," Ralvona.
D. and J. Gagie, "Spy Hill," West Wyalong.
Johns Bros. (R. B. Robb, Manager), "Wollongough," Ungarie.
H W. Belling, "Bexley," Lockhart.
A. B. Dalgliesh, "Blair Athol,' Berrigan.
Carew Bros., "Selbourne," Deniliquin.
D. Cheatley, Thyra (via Moama).

General Details.

Young.—Red loam; ploughed 4½ to 5 inches deep, August, 1919; harrowed in November; scarified late in March, 1920; cross-harrowed and scarified prior to seeding; sown 12th and 13th May; seed, 50 lb., superphosphate, 56 lb.

Tubbul.—Red loam; gravel patches: ploughed 4½ inches deep, September, 1919; spring-toothed in December and again in March, 1920; sown 6th May; seed, 51 lb., superphosphate, 56 lb.

Cunningar.—Red loam; cropped for wheat in 1919; ploughed 4 inches deep early in May; harrowed and sown 14th May; seed, 52 lb., superphosphate, 58 lb.

Culcairn.—Red loam; fourth crop; ploughed 4 inches deep in February, 1920; spring-toothed early in May; sown 11th May; seed, 57 lb., superphosphate, 60 lb.

Henty.—Red loam; old land; ploughed in October, 1919; spring-toothed mid-April, 1920; packed and spring-toothed prior to sowing on 10th May; seed, 48–50 lb., superphosphate, 58 lb.

Ralvona.—Grey alluvial loam; spelled in 1919, but cropped to wheat or oats without intermission for previous eleven years; ploughed 5 inches deep and spike rolled early in April, 1920; sown 5th May; seed, 60 lb., superphosphate, 55 lb.

West Wyalong.—Sandy red loam; clay patches; cropped for wheat in 1919, but fed off; disced in January, 1920; spring-toothed in March; late-sown land spring-toothed at the end of May; early sowing on 8th April; seed, 44 lb., superphosphate, 56 lb.; late sowing on 25th May; seed, 52 lb., superphosphate, 62 lb.

Ungarie.—Dark red loam; cropped for wheat in 1919; spring-toothed, 20th January; harrowed, 8th March; spring-toothed, 14th April; early sowing on 5th April; seed, 47 lb., superphosphate, 56 lb.; late sowing on 6th June; seed, 52 lb., superphosphate, 60 lb.

Lockhart.—Red clay loam; ploughed in July, 1919; harrowed in August and December; spring-toothed in April, 1920; sown on 3rd May; seed, 51 lb., superphosphate, 56 lb.

Berrigan.—Gray clay loam; disc ploughed in August, 1919; spring-toothed in January, 1920; disced and harrowed before sowing; sown on 18th May; seed, 50 lb., superphosphate, 48 lb.

Deniliquin.—Gray and black clay loam; ploughed August–September, 1919; rolled and harrowed mid-May; sown, 20th May; seed, 53 lb., superphosphate, 56 lb.

Thyra.—Gray clay loam; ploughed in August, 1919; spring-toothed and sown on 21st May; seed, 45 lb., superphosphate, 56 lb.

Season.

Following the dry season of 1919 droughty conditions prevailed throughout the summer and autumn of 1920. Rain fell during the earlier portion of this period, but mainly in heavy storms from which the loss by run-off was very great. As a direct result of the dry fallowing period the weed infestation of the ensuing crop was almost unavoidable, there being but little possibility of an early germination of weed seed. In April, the seed-beds were in a very dry condition; May was practically rainless, but the weather broke during the first days of June, and the winter became wet and mild. Spring was moist and cool, and harvest unusually late, which, of course, accounts for the comparatively high yields given by the late wheats, in spite of the fact that in most cases germination did not occur until early June.

Experiments located south of the Murrumbidgee suffered rather badly during the winter months from the heavy and continuous rains that occurred. At Henty the June rainfall was 664 points, and the soil was waterlogged for a period of six weeks. Similar conditions prevailed at Berrigan and Deniliquin, and while at Culcairn the experiment wintered well through being located upon undulating ground, the crop was badly cut about by a phenomenally heavy rain storm in November. Experiments north of the river made very robust growth throughout and promised very heavy yields, but the rain storms of early summer did a great amount of damage to them. In the southern experiments the yields were reduced by late spring wind-storms, consequently the yields of all experiments are lower than might have been anticipated following a survey in early November.

RAINFALL of the Fallow Period, 1919–20.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.
	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.
West Wyalong ...	...	...	...	...	...	...	38	10	141	124
Lockhart... ...	62	72	60	102	46	110	20	...	48	45
Ungarie	...	...	...	...	...	...	9	...	82	85
Berrigan	...	...	...	...	...	...	19	...	8	22
Deniliquin ...	23	33	68	72	98	3	17	37	8	25
Henty	...	...	...	...	26	236	158	...	16	90
Young	53	149	135	60	9	369	59	...	285	89

EFFECTIVE Rainfall during Growing Period.

	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Effective Rain.
	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.
West Wyalong ...	...	383	164	165	189	101	179	229	1,142
Lockhart	25	245	305	289	245	195	356	96	1,320
Ungarie	18	356	187	198	160	160	248	210	1,170
Berrigan	29	218	285	280	299	161	195	98	1,243
Deniliquin	37	153	131	407	204	183	116	60	1,093
Henty	31	664	288	298	191	239	191	50	1,839
Young	1	577	210	336	299	104	271	256	1.662

Variety Trials.

The results of the variety trials appear in the accompanying table. The performance of Canberra is a particularly encouraging one. It "stood" surprisingly well, was without comparison amongst early varieties, averaged slightly better in yield than Federation, and gave the highest individual yield of the series.

Federation withstood the wet conditions satisfactorily, maintaining a very healthy state throughout. Owing mainly, of course, to its habit of growth it bleached rather badly in many localities, but at the same time actual losses of grain were comparatively small.

Gresley No. 83 is a West Australian variety, tried for the first time in the farmers' experiment plots. It was top-yielder at West Wyalong, where it caused much favourable comment; but its comparative yield is discounted by its having been harvested along with Canberra and Florence in good weather. Gresley stripped extremely well, and at Lockhart was the only variety to be harvested without stoppage due to comb-choking. It is tall-strawed and early, and should be a good hay variety for dry districts.

Yandilla King averaged only 48 lb. less than Federation over twelve experiments. It is somewhat surprising that it should have headed the list in such an early district as Thyra, but the late spring rains provided conditions suitable to the development of the later varieties, in spite of the delayed germination.

There is little need for detailed comment regarding the other varieties included in these trials, except that Penny was again successful at Lockhart,

and that the season was a particularly disastrous one for Currawa, which, owing to the delayed harvest, became an almost total loss in many districts owing to the rotting of its matured straw. Further, at Deniliquin it failed to stool, and at Young the head filled badly.

The failure of Hard Federation at Culcairn was due to take-all—practically the only appearance of disease in these experiments.

VARIETY Trials.

	Young.	Tubbul.	Cunningar.	Culcairn.	Henty.	Ralvona.	*West Wyalong.	Ungarie.	Lockhart.	Berrigan.	Deniliquin.	Thyra.
	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb	b. lb.	b. lb.
Bomen	..	15 20	..	20 57	15 19	21 13	..	18 49	15 59	22 59	16 33	27 25
Bunyip	..	..	..	..	..	..	..	20 15	..	..	..	..
Canberra	36 41	25 21	27 46	23 28	..	18 12	30 5	26 47	15 59	21 29	20 33	28 34
Cedar	..	..	..	..	..	..	21 40	..	..	..	..	..
Comeback	..	..	..	..	..	..	..	16 0	..	..	..	..
Currawa	28 49	17 33	16 56	19 54	..	17 39	19 44	20 20	9 17	15 45	10 51	25 54
Federation	31 39	27 0	29 26	29 20	12 56	25 43	26 20	22 4	23 40	17 19	17 30	26 15
Firbank	..	11 37	..	..	..	..	..	21 8	..	..	..	..
Florence	22 31	..	..	..	..	..	25 48	23 57	..	..	..	..
Golden Drop	..	..	..	..	..	..	..	24 4	..	..	..	..
Gresley 83	..	..	..	22 9	16 44	23 16	35 53	..	20 12	..	16 44	..
Hard Federation ..	32 23	18 1	22 30	11 49	11 33	25 12	25 9	14 39	19 1	20 23	18 4	25 59
Improved Steinwedel	..	..	..	..	..	..	..	15 17	11 37	18 40	..	..
Jade	..	..	..	..	..	..	23 28	..	..	..	..	..
Marquis	..	..	..	..	..	..	26 7	..	..	..	..	..
Marshall's No. 3 ..	..	19 59	20 50	..	12 23	20 28	..	21 48	14 28	16 25	..	..
Penny	..	17 24	20 28	26 59	15 10	20 42	..	..	24 20	..	14 57	..
Thew	28 43	..	..	..	12 9	..	..	17 4	..	..	19 24	..
Warden	..	..	..	22 32	16 55	..	..	..	16 3	..	..	..
Yandilla King ..	31 50	25 23	25 16	22 34	13 31	..	32 12	16 12	23 25	20 44	14 48	28 45
Zealand	27 33	..	13 40	..	8 12	..	..	..	..	..	.	..

*NOTE.—At this centre the varieties Canberra, Florence, and Gresley 83 were harvested before the heavy rain of late November and December.

MANURIAL Trials.

—	Young.	Tubbul.	Cunningar.	Culcairn.	Henty.	Ralvona.	West Wyalong.	Ungarie.	Lockhart.	Berrigan.	Deniliquin.	Thyra.
	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.	b. lb.
Superphosphate, 28 lb. per acre ..	28 36	25 13	30 1	14 33	14 4	24 40	24 59	23 23	17 0	17 3	15 52	23 11
Superphosphate, 56 lb. per acre ..	31 39	27 0	29 26	17 27	12 56	25 43	26 20	22 4	23 40	17 20	17 30	26 15
Superphosphate, 84 lb. per acre ..	28 28	27 16	24 5	15 12	14 55	24 5	25 40	23 12	20 53	17 0	14 12	26 13
Superphosphate, 112 lb. per acre	..	..	..	..	..	..	..	..	..	17 40	..	..
Basic Superphosphate, 56 lb. per acre	27 27	..	..	15 27	..	..	..	..	24 16	..	..	..
P7, 84 lb. per acre.	28 52	..	..	..	..	26 3	..	..	..	..	..	..
No manure.. ..	24 12	16 19	26 57	14 33	10 29	23 23	24 29	20 20	16 17	15 38	18 21	19 23

The mixture P7 consists of equal parts of superphosphate and bonedust.

The Manurial Trials.

Manurial trials were conducted at each centre, and attempts were made to compare what may be regarded as the standard rate of application (56 lb. of superphosphate per acre) with a heavier manuring (84 lb.) and a lighter (28 lb.), and also with no manure. The results indicate that the standard proved the most profitable rate, averaging 4 bushels 20 lb. more than the unmanured, and outyielding the 28 lb. and 84 lb. dressings by 1 bushel 34 lb. and 1 bushel 20 lb. respectively—a result uniform with the experience of previous seasons.

Additional plots of superphosphate 112 lb., basic superphosphate 56 lb., and P7 84 lb. were included in several experiments with the following results :—

Superphosphate 112 lb.—At Berrigan the use of 112 lb. superphosphate increased the yield over 56 lb. by only ⅓ bushel per acre.

Basic superphosphate 56 lb.—At Ralvona, Culcairn, and Lockhart basic superphosphate gave an average yield of 1 bushel 52 lb less than the corresponding plots of 56 lb. superphosphate.

P7 Mixture 84 lb.—At Young and Ralvona P7 averaged 1 bushel 14 lb. less than the adjoining plots of 56 lb. superphosphate.

It would appear that the application of 56 lb. of superphosphate must still stand as the most profitable.

Early *v.* Late Sowing.

Tests of early *v.* late sowing were included at West Wyalong and Ungarie. The results were as follows :—

	West Wyalong.		Ungarie.
Early (8.4.20) ...	26 bushels 20 lb.	Early (25.4.20)...	22 bushels 4 lb.
Late (25.5.20)...	26 bushels 23 lb.	Late (6.6.20) ...	19 bushels 40 lb.

The season was favourable to late sowings, and the early sowings, because of their slightly more robust growth, were storm-damaged to a relatively greater degree.

Graded *v.* Ungraded Seed.

Graded seed was compared with ungraded at Culcairn and Tubbul with the following results :—

	Culcairn.	Tubbul.
Graded ...	17 bushels 27 lb.	27 bushels
Ungraded ...	19 bushels 51 lb.	20 bushels 41 lbs.

At Tubbul the results emphatically favour graded seed. At Culcairn the graded plot was damaged by storm-water, but it can be said that the sowing of ungraded seed has nothing to recommend it; quite apart from the importance of the removal of possible weed seeds, ungraded seed contains a large amount of grain valuable as feed but useless as seed, and the saving and utilisation of this material is sound practice.

Rates of Seeding.

Tests to determine the most profitable rate of seeding were carried out at five centres, as shown below, 45 lb. of seed per acre being taken as the standard, and 33 lb. and 57 lb. as the rates for light and heavy sowing

respectively. Additional plots of 63 lb. and 70 lb. per acre were included at three centres. It is, of course, impossible to get absolute uniformity in rate of sowing owing to the variation in drills, but in every case the margin was not greater than from 1½ lb. to 2 lb. of seed per acre.

Except at Tubbul the results were consistently in favour of heavy seeding. This was probably due to the late germination of all sowings referred to earlier.

SEEDING TESTS.

Seed.	Ungarie.	Thyra.	Berrigan.	Ralvona.	Tubbul.
lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
33	22 35	......	......	......	20 43
45	22 4	26 15	15 18	......	27 --
57	23 4	27 42	......	25 43	23 59
63	......	......	18 20	......	......
70	......	......	......	25 20	......

Acclimatized v. Unacclimatized Seed.

A test of local Federation against seed of the same variety direct from Wagga Experiment Farm was carried out at Deniliquin. The result was:—

Unacclimatized seed...	...	17 bus. 30 lb.
Acclimatized (local) seed	...	15 ,, 12 lb.

Oat Experiments.

Variety trials of oats were planted at West Wyalong, Lockhart, Cunningar, Culcairn, and Young, but owing to the very boisterous harvest weather the plots were so damaged that returns are available only from West Wyalong, and even there quite 40 per cent. of the grain was beyond recovery. The yields were:—

Guyra	... ...	26 bus. 35 lb.
Sunrise	... ...	26 ,, 3 ,,

The preparation of the soil was identical with that of the wheat plots. Guyra was sown on 8th April, 40 lb. of seed being used, and Sunrise on 25th May 55 lb. of seed, 56 lb. superphosphate being used with both.

Barley Experiments.

Barley variety trials were included at Young and Henty. At Young the plots were totally destroyed by heavy falls of rain late in November and early in December, the heads being completely stripped from the stalks.

At Henty the yields were very low, the plots never recovering from the saturation of June and July. In comparison with the yields of the wheat section at Henty, the barleys failed badly, reversing the 1919 results when the barleys heavily outyielded the wheats.

The yields were:—

Goldthorpe ...	...	11 bus. 22 lb.
Golden Grain	...	9 ,, 49 ,,
Kinver ...	...	9 ,, 19 ,,

The Elimination of the Unfit.

J. T. PRIDHAM, Plant Breeder.

It is gratifying to note that the Council of the Royal Agricultural Society is now considering a movement among farmers that has for its object the production of pedigree seed. It is only fair to state that this process has been going on for many years at the principal Departmental farms in the wheat-growing districts as part of the regular routine—the Manager of Wagga Experiment Farm, for instance, would almost as soon think of allowing a cross-bred bull in his Jersey herd as he would think of sowing a paddock with Hard Federation wheat obtained from a dealer or neighbouring farmer. The grain used to produce seed wheat for sale is obtained from stud or pedigree plots sown from single selected plants of the variety. We regard the wheat crop as a population, and the variation everywhere seen in nature enables us to earmark certain individuals. These, in the main, breed true and reproduce themselves faithfully. It does not take long to raise, by thin sowing, a strain which will yield bushels more to the acre than the common run of seed from which the dyspeptics and consumptives have not been eliminated. This rejuvenating and revitalising process is more essential than mechanical grading (important in its place), and has to be maintained year after year or else, with clockwork regularity, the quality of production will drop back to the dead level of mediocrity. Seed wheat or oats of this stamp is absurdly cheap at the price sold on Government farms. What the Department advises is that farmers should buy a bushel or a bag of the improved seed every year and thus keep their seed up to the standard. Of course, a farmer could carry out the system on his own property; but for those who have not the time or inclination the best way is to buy a small lot regularly from the nearest experiment farm. When Departmental officers see grain of imported varieties, inferior to our own, sold for four times their value simply because they have been advertised and because the public like a novelty, we may be pardoned if we cry our own wares, even though the sound is unusual.

This paper, however, is to awaken a new interest in the minds of growers for crops that are sown in a wholesale way or in bulk, as wheat, oats, potatoes and summer fodders. If such crops were sown thinly—say, to single plants as in an orchard—we would long ago have been alive to the necessity of cutting out the unproductive individuals. An old potato grower remarked that he should have started rejecting the poor hills in his field long ago, instead of mixing the tubers when dug and using the small ones for sowing irrespective of their family history.

The cry to-day is for increased production, and it can be brought about by the use of more vigorous seed without an extra rod of ground being brought

under the plough. The farmer has a most powerful means at his disposal in selection—a means which statesmen and eugenic reformers would like to use with the human subject, did any parliament pass such heroic measures. A census taken recently in England of drafted men for the first eight months of 1918, shows that of 2,000,000 men examined only 36 or 37 per cent. were up to a normal standard of health, strength and fitness. The men medically examined were a fair sample of the nation; and as the result of the prevailing industrial conditions, overcrowding, and a strenuous life with too little nourishing food, approximately two-thirds of the population were unfit to maintain the battle of life with full vigour.

A word or two in regard to the method of procedure with plants. A farmer who saves a patch of crop for seed which has grown more vigorously than the rest of the paddock is only on the first step of the ladder to improvement. The well-grown patch of crop may have fewer wild oats, and the grain may even be plumper than the rest of his crop, but the improvement is merely due to a little extra soil moisture or fertiliser, to better cultivation or richer soil. Such seed will not produce a uniformly vigorous crop next year, because it still consists of a mixed population. We need to "line up" plants singly for inspection before we are in a position to see what sort of individuals we have for seed mothers; it only needs to be done once to convince the most casual farmer of the existence of many weaklings and sick plants in the average crop. Cut these out, and we are making strides towards higher production.

Crop plants can be bred on the same principle as animals, and their rate of increase is infinitely greater, besides being more subject to control. We have a variety of barley named Cowra No. 21, which is very like Pryor's barley, and which we propose calling Pryor's Improved. It has yielded better than Pryor's, because of the course of selection that it has been through and because the material in the first place was good. No amount of selection will improve a naturally unproductive variety among self-fertilised plants. On the other hand, just as in the animal world, in any crop the more careful and thorough the culling process, the higher will be the yields.

The Water Requirements of Wheat Varieties.

An attempt was made in the state of Oregon, U.S.A., in 1919, to determine whether the apparently greater yielding capacity of Hard Federation as compared with Early Baart (one of the best known varieties locally) was due to a lower water requirement. As a result of a transpiration experiment, it was found that while Hard Federation produced a crop of grain on 1,551 lb. water, Early Baart required 2,422 lb. Relatively to the wheat of other countries Australian wheats have a very low water requirement—a character no doubt connected with the popularity of wheat as a crop in this country.

Field Experiments with Fodders.

Cowra Experiment Farm.

C. McCAULEY, Assistant Experimentalist.

Winter Fodder Trials, 1920.

[The Experiments Supervision Committee, under whose control these experiments are being conducted, wish to draw the attention of farmers to the fact that the results are only those of one year's trial, and that final conclusions cannot yet be drawn.]

It must be borne in mind in relation to the results given hereunder that several considerations besides that of yield should guide one in the selection of a winter fodder. Since the crop is required in the late winter or early spring, earliness of maturity is also essential. For this reason a variety like Hard Federation may be preferable to Zealand. The former gives less fodder but is ready to cut nearly a month earlier—a fact which outweighs the consideration of a difference of only 14 cwt. in a yield of 6 tons 10 cwt.

Again, quality of fodder, and the purpose for which it is required, must be considered. For instance, although in this test the swedes have given a very low yield, their feeding value ton for ton for sheep and cattle is higher than that of the other fodders—how much higher under Cowra conditions is a matter which must be left to a possible feeding experiment in the future. There are also great variations in the fodders in respect to palatability, and these call for consideration too.

A crop may be intended for use during the late winter, but circumstances occasionally arise (for instance, abundance of grass at this season) rendering it more profitable to allow, if possible, the crop to mature either for hay or grain, and to turn stock on to the natural pastures. This point must not be lost sight of in choosing a fodder which, other things being equal, may, if necessary, serve the second purpose. Rape, for example, although a useful crop in a rotation with wheat, has not this advantage.

The previous crop on the land used for this experiment was rape, sown in February, 1919. The land was ploughed on 2nd and 13th January, 1920, spring-tooth cultivated between 12th and 16th February, and skim ploughed between 10th and 20th March. Sowing took place on 25th and 26th March, superphosphate being applied at the rate of 60 lb. per acre. At the time of sowing, the ground was very dry, and did not contain sufficient moisture to cause germination. Germination took place on 24th April, as the result of rain falling between 12th and 14th April.

Owing to the hot, dry weather during May the plants made very little growth until June, but during that month and those following, good rains fell, and as a result the plants grew vigorously. Rye, Sunrise oats, and Cape barley made the best growth during the winter months; rape and swede turnips germinated too late to give the best results. Owing to the

impossibility of obtaining Skinless barley seed, Canada field peas were sown in the vacant plot on 11th April; they were sown too late, however, and did not attain sufficient growth to harvest. All plots were free from disease.

The rape, swede turnips, and Canada field peas were cultivated on 25th June and 23rd August. Rape and rye were the only varieties which made sufficient second growth to harvest. All plots were harvested at their maximum period of development and weighed immediately after cutting. The area of the plots was a quarter-acre.

The rainfall during the growing period was as follows:—March, 52 points; April, 170 points; May, 6 points; June, 568 points; July, 262 points; August, 324 points; September, 234 points; October, 304 points; November, 155 points. Total, 2,075 points. During January, February, and March (up to the date of sowing) 281 points fell.

The yields were as follows:—

Varieties in order of merit (based on percentage yield).	Rate of seed per acre.	Yield per acre (based on percentage).			
	lb.	t.	c.	q.	lb.
Cape barley	36	8	16	1	2
Sunrise oats (check)	40	8	0	2	15
Rye	30	7	7	3	25
Algerian oats	40	7	1	0	22
Zealand wheat	42	6	10	0	17
Rape	5	5	18	2	4
Hard Federation wheat ...	42	5	16	3	25
*Swede turnips	5	2	13	2	22

* The tops of the swedes were cut and weighed, and all roots worth digging were also dug up and weighed.

Analyses of Lucerne and Tree-lucerne.

The following table shows the compositions of "tree" lucerne (tagasaste) and ordinary lucerne. It will be observed they are very similar:—

	Ordinary Lucerne.	Tree Lucerne.
	Per cent.	Per cent.
Water	73·5	75·0
Albumenoids	6·6	7·4
Ether extracts	0·4	0·1
Ash	2·3	2·4
Fibre	6·2	6·0
Carbohydrates	11·0	9·1
	100	100
Albumenoid ratio ...	1 to 1·8	1 to 1·3
Nutritive value	18·5	17·

—F. B. Guthrie.

Farmers' Experiment Plots.

HAY TRIALS, 1920.

Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Assistant Inspector of Agriculture.

HAY trials with oats and wheat on the above areas were carried out during 1920 season on the properties mentioned below. Although the crops were grown on irrigable land, owing to the exceptionally good rainfall during the growing season it was only found necessary to irrigate in one instance.

L. R. Brown, Farm 142, Yanco.
E. H. Ronfeldt, Farm 797, Whitton.
A. F. R. Tiffen, Farm 319, Leeton.
J. M. Seton, Farm 351, Leeton.

The Season.

Owing to the exceptionally favourable season, it can hardly be said that the experiments were carried out under irrigation methods; in fact, owing to excessive rains, the yields were decreased on some of the heavier land by rain water lodging on the land and scalding the crop. It was noticeable that the later sown crops gave the heavier returns. This was due chiefly to the good start and rapid growth made by them following the winter rains, and the absence of any check. In the case of the earlier sown crops, while the land was in excellent condition at sowing time and a good germination resulted, the hot, dry weather that ensued quickly dried out the soil and the crops suffered a set-back, for it is not always advisable to irrigate before good growth has been made. Doubtless if only a light fall of rain had occurred earlier the first sown crops would have given heavier yields.

In such a season as that just experienced—very dry at sowing time followed by good rains six weeks to two months later—too much care cannot be given to the preparation of the seed-bed, as in the heavier soils it may mean the difference between success and failure; for even with irrigation water available, unless the land be well ploughed and cultivated at the proper time after irrigating, it dries out to such an extent that very patchy germination may result.

The rainfall registrations were as follows:—April (after sowing), nil: May, 31 points; June, 213 points; July, 276 points; August, 261 points; September, 286 points; October, 166 points; November (to 18th), 37 points; total, 1,270 points.

The Plots.

Farm 142.—Soil rather heavy; previous crop oats (fertilised with 56 lb. superphosphate); ploughed in February, well work down, and irrigated at the end of March previous to sowing. Sown at the rate of 1 bushel per acre. Variety trial fertilised with 56 lb. superphosphate per acre.

In the manurial trial the plot fertilised with M5 was reduced in yield owing to the effects of the heavy rainfall, the water scalding portion of the crop.

The early maturing varieties Firbank and Canberra were cut on 18th October and the others twelve days later.

Farm 797.—The soil here was rather uneven, the oats being grown in crab-holey country; this class of land seems suitable for the growing of oats, some very heavy crops being obtained on the area this season. Previous crop, peas. Seed sown on well-prepared land, previously irrigated on 17th and 19th April; germination good, but owing to the land drying out it was found necessary to irrigate the crop during the first week in May. Crop made rapid growth after June rains, but portions subsequently showed effects of too much water. Owing to the attacks of rust, Guyra and Sunrise oats were cut earlier than otherwise they should have been; both these oats grew very tall, some of the Sunrise attaining a height of over 8 feet. A little of both varieties lodged, but this chiefly occurred on the "puffs"—rises in the crab-holey country, which, although they have been graded off during the preparation of the land, rise again after rain or after being watered, giving the land the appearance of having puffed up. The growth on these "puffs" is invariably rank and luxuriant. The Algerian oats and the wheat were cut on 4th November.

Farm 319.—Better class soil of the area; land well fallowed; previous crop millets (fed off with stock); same rates of seeding as in other plots, with ½ cwt. superphosphate. Sown 11th and 12th May; came away very quickly and received the full benefit of the first rains in June.

The Sunrise oats stooled much better than is usually the case with this variety; the oats grew over 7 feet high and the wheat attained a height of 6 feet. The early maturing wheats were harvested on 19th October and the others in the first week of November. The crops on this plot were not so badly affected with rust as those in the other trials.

Farm 351.—Sown 4th and 5th May on red clay loam; previous crop, oats (unmanured). All sections germinated well and good growth followed. Early varieties cut 18th October, and late maturing varieties 3rd November.

General.

Hard Federation was sown in these trials for the first time and gave very promising returns, although in some instances the crop was badly affected with rust. Bomen does not appear a suitable variety for growing under irrigation methods, as it very quickly shows bad signs if there is excessive water, and without plenty of moisture the growth is rather short. Canberra is very easily distinguished by its light-coloured straw and upright growth of flag. A big fault appears to be the weakness of the straw, which bends over and then makes an upright growth again; this was noticeable throughout the plots. The hay was fine in the straw.

Yandilla King gave very good returns, and is one of the best wheats for the areas. Zealand upheld its former reputation for suitability for the areas, giving good heavy returns of fine quality hay with good ears, fairly

free from flag and little attacked by rust. It may be said this wheat is first choice as a hay wheat under irrigation. Even if this variety should be sown late and the season turns dry in early spring one watering will assure a good yield of hay.

Of the varieties of oats Algerian appears to be the most suitable for hay purposes. It is not as badly affected by rust as the other varieties, is a better stooler, and stronger and finer in the straw, although it may be a little later in maturing.

RESULTS of Variety Trials.

Variety.	Farm 142.				Farm 797.				Farm 319				Farm 351.			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb	t.	c.	q.	lb.
Yandilla King	3	1	3	24	2	17	0	7	....				....			
Marshall's No. 3 ...	2	18	0	8	2	16	3	0	3	17	1	26	2	17	1	16
Hard Federation ...	2	12	3	0	2	15	1	7	....				2	11	0	0
Canberra	2	12	0	14	2	13	2	7	3	15	3	17	....			
Firbank	2	10	1	22	2	10	2	14	3	16	2	23	....			
Bomen	2	8	3	14	2	11	3	0	....				2	5	1	2
Zealand	....				....				4	1	0	12	3	2	2	0
Florence	....				....				3	14	1	26	2	8	3	6
Algerian Oats	....				2	19	3	0	3	18	0	12	2	2	1	0
Guyra	....				2	19	0	0	3	19	1	20	1	19	0	0
Sunrise	....				2	16	0	7	3	13	2	17	1	18	3	0
Ruakura	....				....				....				1	17	1	7

RESULTS of Fertiliser Trial (Variety, Yandilla King).

Fertiliser per Acre.	Farm 142.				Farm 797.				Farm 351.			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
¼ cwt. P8	3	3	0	16	2	17	3	0	2	19	0	3
¼ cwt. P7	2	19	2	24	2	16	1	7	2	15	1	21
½ cwt. M5	2	18	2	13	2	16	0	0	2	14	1	10
¼ cwt. Superphosphate ...	3	1	3	24	2	17	0	7	2	12	2	18
¼ cwt. Basic Superphosphate...	....				....				2	8	3	27
No manure	....				....				2	4	3	5

P8 consists of equal quantities superphosphate and blood and bone; P7 of equal quantities of superphosphate and bonedust; M5 of 2 parts superphosphate and 1 part sulphate of ammonia.

WHEAT VARIETIES UNDER TRIAL.

AT Condobolin Experiment Farm during the past season the wheat Billy Hughes yielded at the rate of 27 bushels per acre, Cowra No. 6 at 30 bushels, Red Wings at 29 bushels, and Clarendon 26 bushels. In all cases the seed was sown in April, 1920, at 45 lb. per acre, and with 45 lb. superphosphate, and though partial germination took place after showers in April and May, a good start was given the planting by rain in June.—E. W. KENNEDY, Manager, Condobolin Experiment Farm.

Improved Transport in Dairying Districts.

A Quick and Cheap Service.

L. T. MacINNES, Dairy Expert.

The Railway Commissioners' response to representations put before them by the Department of Agriculture (Dairy Branch) in connection with the transport of cream daily from farm to factory along the Grafton-Lismore railway has done a great deal towards bettering the condition of the cream delivered for manufacture, and therefore for the quality of the butter produced by the factories concerned; but it has also opened up possibilities for other districts.

This mode of transport has proved successful in the present trial, and with better and more powerful motors an improved service is confidently looked for. On many of our coastal rivers there are large areas of fairly level land where dairying is carried out extensively; this also applies to such

The Rail-motor on the Lismore-Grafton Railway Line.

closely settled localities as the Yanco Irrigation Area, Leeton. In all these districts one of the chief drawbacks to the manufacture of a choicest grade butter or cheese is the transport problem—the delay in getting milk or cream quickly and cheaply from the dairy farm to the factory. The idea presents itself that by laying down rails on the roadsides and establishing a road motor service, this difficulty could be got over at less expense, both in laying down the track and in maintenance, than would be the case if existing roads were macadamised and kept in good repair for the use of ordinary motor lorries. Dairy produce (and fruit also) suffers rapid deterioration by rough haulage, while any lengthy delay and exposure to the heat in transit to the factory, especially during the summer months when the dairying and fruit seasons are at their height, cause great losses to the producers.

In view of the possibilities, the following article on rail-motor services is especially interesting and opportune. It is hoped that there will be a rapid extension of the system. It might even receive favourable consideration by the local authorities controlling the main roadways of the State. Undoubtedly one of the main factors in developing any country is the provision of good roadways, to enable what is produced to be brought to the centre where it is to be sold or handled, not only quickly, but cheaply, and with the least damage possible. The utilisation of motor traction on rails seems to meet these requirements.

The Possibilities of the Rail-motor Service.

O. C. BALLHAUSEN, Dairy Instructor.

About eighteen months ago a rail-motor carriage was placed on the Grafton-Lismore line to serve the requirements of passengers on that section of railway on days on which the usual trains did not run. This portion of the line has never been a paying one, and to somewhat reduce the annual loss the Commissioners had been compelled to withdraw the usual service on three days of each week. It was to meet the demand for a return to a daily passenger and cream delivery service which immediately followed the curtailment in traffic that the experiment with a rail-motor capable of carrying passenger and light goods traffic was made. The innovation has proved highly successful. For a considerable time only passengers and light parcels were carried, but for the past six months a special louvred truck for the carriage of cream and heavy parcels has also been in use.

The reduction of the train service inflicted a heavy handicap on dairy-farmers on this route, as it meant that cream would have to be held and cared for on the farms for longer periods. To retard deterioration during the sultry summer weather is difficult enough at any time, but when the period over which this care had to be exercised was extended by the withdrawal of the trains, the attention necessary was still greater. The advent of the rail-motor means a fast passenger, cream, and parcel service for the district, and should mean for the Railway Commissioners a profitable service.

As already mentioned, the venture was purely an experiment. Queensland and Tasmania had already attempted something of the kind, but the New South Wales Commissioners went further, and provided probably the best rail-motor of its kind in Australia to-day. The basis of the car was originally a 5-ton lorry of 40 horse-power. To convert it into a carriage, the chassis was lengthened and strengthened. Large flanged wheels were substituted for the ordinary back wheels, and a four-wheel bogie, similar to a locomotive bogie, for the front wheels. A number of other necessary alterations, which need not be entered into here, were also made. The accommodation is very comfortable; the carriage is gas-lighted and seats from thirty-five to forty passengers. So popular did the car become owing to the

degree in which it reduced the time occupied on the journey, that it quickly seen that the accommodation was insufficient, and the Commissioners are now building cars of 150 horse-power at their Eveleigh workshops.

The efficiency and low cost of upkeep of the petrol-driven rail car make it probable that many centres that would not have warranted the construction of lines suitable for steam traffic for many years will now be connected by light rails with main lines. To illustrate the possibilities in this direction it should be borne in mind that the engine in "Rail Motor No. 1" is only a four-cylinder 40 horse-power, and the chassis was originally intended to carry 5 tons. The carriage portion of the rail-motor, inclusive of chassis, body, &c., weighs over 8 tons, and passengers and luggage would weigh 2½ to 3 tons. In addition to this it hauls a van loaded weighing slightly over 6¼ tons. The fact that the car runs on a smooth rail surface and is provided with gears to meet the variations in grades makes all this possible.

With a sufficiently powerful car, it is possible to draw several trailers or vans. This type of service should be particularly suitable for the smaller coastal centres, situated some distance up branch streams (Nimbin, for instance), and devoted primarily to dairy produce and fruit-growing. Produce from dairying centres is principally of a more or less concentrated type, and, whilst fairly heavy, it has not the bulkiness of produce from, say, our wheat and wool growing areas, where numerous rail vehicles are required. Moreover, the settlement in our dairying centres is fairly close, ensuring a fairly regular passenger traffic to the more important towns. Only very light lines, bridges, and culverts would be necessary, curves could be much shorter, and probably fairly steep grades could be more easily met by means of the variable gears—gears that a steam locomotive lacks. In many places the lines might follow the routes of existing roads—which are often not roads at all—and relieve them of much heavy traffic.

In view of the forecast by certain journals devoted to motoring, that the effort was doomed to failure owing to the antipathy of the "old school" locomotive engineers, a pleasing feature of the inauguration of this class of transport on the railway is the sustained interest shown by all railway officials. It is fully realised by the officials that there are big possibilities in its development, as the Commissioners report on the nine months' working illustrates. The report says:—

"A motor train service, given by a converted 5-ton motor lorry, petrol-driven, was put into operation over the section Grafton-Lismore in October. 1919, and has proved successful, although the type of motor is not the most desirable for the purpose. During the year (nine months) a mileage of 16,346 miles was run, and 7,157 passengers were carried. The earnings amounted to £2,377 and the working expenses to £922 or 38·79 per cent. of the earnings.

"In view of the satisfactory results obtained, the Commissioners propose to construct more motor vehicles as rapidly as suitable motors and other material can be obtained, and to extend the service for passenger transport over other branch lines in the State."

The Production of Better Seed in other Countries.

E. BREAKWELL, B.A., B.Sc., Agrostologist.

THE improvement of cultivated plants and the commercial production of seed from such improved "lines" of plants have been for some time vigorously undertaken by European countries, and also by America. The two nations most outstanding in this respect are Sweden and Canada. The methods adopted in Sweden have served as a model for other nations, and there follows in brief an account of the methods employed. For a large part of the information I am indebted to Mr. W. R. Birks, B.Sc. (Agr.), an officer of the Department, who visited the country after his war service, and subsequently compiled a report of his investigations.

The Swedish Institute at Svalof, for the improvement of cultivated plants, has been in existence for over thirty years. In close co-operation with the Institute is the General Swedish Seed Company, a private commercial body for growing, treating, and selling farm seeds in bulk, such seeds being the direct result of the work carried out by the institute. The latter is subsidised by the Government, and these funds, together with those obtained from the seed company for the sale of the seed, and from other sources, are sufficient for the employment of the most expert officers in plant-breeding work.

Very little progress was made at first, owing to the fact that the work was carried out on the lines of Darwin's theory of selection, which is based on the hypothesis that a systematic and continuous selection of plants characterised by certain traits should lead to the creation of a new form, possessing the desired traits as hereditary characteristics. The work was, in consequence, more or less haphazard, as, instead of the plant being treated as a distinct unit, thousands of plants were examined for the variations in the particular organs, such as grain, stalk, &c.

The investigations of De Vries, in the latter end of the 19th century, showed that plants could break away suddenly and completely from the type, such plants being called mutations. This principle was adopted by Dr. Nilsson Ehle at the Svalof Institute; and by treating the plant as an individual unit more rapid progress was at once made. Starting with thirty different plants culled from a wheat field in 1890, in 1893 the number was increased to 2,000, each plant possessing a definite characteristic. The seed from such individual plants is sown, and certain distinct types are soon 'fixed," *i.e.*, remain constant. The superior types are extended as quickly as possible, in order to place the seed on the market. The seed from the bulk plots is placed under the control of the General Swedish Seed Company,

which in turn extends its operations on its own land, and enters into contracts with private growers. The resulting progeny of the seed is never lost sight of, as the institute's experts continually supervise the seed farms, and see that the strains remain true and superior in type.

Improvement work is also carried out with beets, potatoes, clovers, and grasses. To form an idea of the vast proportions to which this improvement work has grown it might be mentioned that at present over 4,000 different types of cereals alone are grown on the farm, and there are in existence altogether 10,000 plots. A good deal of work is also carried out in the improvement of plants by means of crossing. It is recognised, however, that selection is the fundamental factor in all this work, as the required superior types must be selected and fixed before crossing is effected.

"Nilsson Ehle," states Mr. Birks, "might be well termed the Farrer of Sweden. As the result of his work, combined however with the extraordinary richness of the soil, cereal yields up to 90 bushels per acre are obtained. In one of the most successful wheats the original crossing was made on ten or fifteen mother plants, producing 100 to 200 developed kernels. The progeny of these in the F_2 generation should be, say, 40,000 plants. Of these the winter culls 50 per cent.; for liability to rust and weakness of straw 75 per cent. of the remainder are discarded before harvest; this leaves 4,000 or 5,000 plants. From the results of stringent examination, 100 to 200 of the best plants are selected to form families in the F_3 generation; twenty to thirty of the best of these again go into small plots in the following year, and in the fifth generation some half dozen are selected for the large comparative trials. In the meantime stringent 'culling' is effected within these lines, and fresh selections are made for the re-developing of pedigrees as from the F_2 in the first place. As the result of these methods one of their successful crosses, viz., Iron wheat, has an increase in yield of 45 to 50 per cent. over the old native wheats of Sweden."

Seed Contracts with Growers.

As already pointed out, the General Swedish Seed Company buys all the improved bulk seed from the institute for further commercial production. It extends further production on its own land, and also enters into contracts with private growers. The terms of such a contract are, briefly, as follows:—

1. The grower undertakes to grow the seed for the Swedish General Seed Company.
2. The grower is bound to deliver to the seed company without remuneration the same weight quantity as received, with an addition of 25 per cent.
3. The grower is bound to deliver the entire balance of the crop to the seed company for a fixed remuneration.
4. Should the company be unable to accept the average quality sample which the grower is bound to send to the company, then the grower's obligation shall cease.

5. The grower shall deliver the crop in clean condition.
6. The grower binds himself to allow the seed company's representative to inspect at any time, and at the company's expense, the growing crop at any place.
7. Should the crop not be approved of as seed goods by the seed company on account of faulty harvesting, ill smell, low germination, mixing with foreign sorts, diseases, or other causes, and providing this is caused in any way by neglect or improper handling by the grower, he shall be bound, if so claimed, to pay for the seed he received at the price quoted for the goods in question in the year's catalogue.
8. Should the goods delivered be found not up to sample, or should they show upon closer examination that they do not reach the standard mark on the measure, and the goods so be in any case unfit for seed, they will then be valued according to the mutual agreement of the grower and the seed company.

Progress in Canada.

It seems practically certain that the Swedish method was a model for Canada. A Canadian Seed Growers' Association was founded in 1900, its functions being an extension of the Agricultural Department's activities. It is realised that the Department is not in a position to control the multiplication and distribution of the improved sorts in a large way, and to the best advantage among individual farmers, and that the work is best done (as in Sweden) by a separate and independent organisation. The association appoints provincial officers for the field inspections, and its own officers for the final inspection in the sack.

The method adopted by this association is as follows:—

1. Membership of the association is open and free to any *bonâ fide* farmer who has shown himself capable of producing improved pure seed.
2. The farmer who undertakes to grow pure seed obtains his foundation stock from the association. Such seed is either "first generation registered seed" (*i.e.*, the first, second, or third generation progeny of an improved selected strain), or "elite stock seed" (a pure stock of seed originating from a single plant, or obtained from a hand-selected seed plot).
3. Any seed of any kind of crop produced or selected by a member during the succeeding years is entitled to registration by the association.
4. Two kinds of certificates are given by the association—(1) for seed which has been grown according to regulations, and descended from "elite stock seed," such seed being marked "registered seed" and (2) for pure "elite stock seed."

5. No certificates are issued unless the seed be (*a*) pure as to variety and true to type; (*b*) free from seeds of other cultivated plants; (*c*) free from seeds of weeds coming within the meaning of the term "noxious weeds" as applied to the Seed Control Act; (*d*) free from or containing not more than a total of one seed of other weeds of minor importance; (*e*) well matured, clean, sound, plump, of good size and colour, and free from disease; (*f*) up to the percentage standard of vitality recognised for good seed of the kind under the Seed Control Act.

The methods thus outlined are eminently successful. Already the membership of the association runs into considerable numbers, and the demand for "registered seed" is greater than the supply.

The Department of Agriculture in New South Wales has already taken the initial steps for the production of better seed, and the lines upon which it is proceeding have already been indicated in the *Gazette.* The method adopted differs from those in Canada and Sweden in the fact that the Department deals directly with the farmer. The principle of producing pure improved seed is such a vital one that the scheme merits the attention and co-operation of all good farmers.

Local Results with Glencope Wheat.

Glencope wheat is a product by Mr. Henry S. Cope, of South Australia, who recently sent a sample to the Department for trial in the drier parts of the State. The seed was sown at Temora Experiment Farm, the manager of which subsequently supplied the following report:—

"Sowing took place on 21st May at the rate of 50 lb. of seed and 56 lb. superphosphate per acre, but germination was not effected until after the rain in June. The variety proved to be of the purple straw type, maturing at mid-season, somewhat resembling Steinwedel, the ear, however, being more closely packed, and the grain holding more firmly. It stools fairly well, produces a tall straw which stands up satisfactorily, and acquires a purple colour prior to ripening. It is easy to strip, but holds its grain satisfactorily. The plot of Glencope yielded 15 bushels 22 lb. per acre, and the yields of the other varieties sown in the paddock under similar conditions (with the exception that they were sown in large blocks) were: Gresley No. 83, 21 bushels per acre; Hard Federation, 18 bushels; Firbank, 16 bushels."

The only effective method of getting rid of docks is to dig them out with the mattock, making sure that the roots are taken out. Constant cultivation between rows of maize and potatoes, &c., will usually keep docks in check, but in lucerne fields or pasture the first-mentioned method is the only means of control.—A. J. Pinn, Inspector of Agriculture.

Varieties of Oats Tested in New South Wales.

J. T. PRIDHAM, Plant Breeder.

ALTHOUGH the oat crop is not nearly of the same value to this State as wheat, the area sown has been steadily increasing since 1914. It is satisfactory to note this, because large quantities of oats for feed purposes are still imported whereas we should be in a position to be self-supporting in this respect.

Oats are most useful to the wheat farmer, being, for one thing, the crop that it pays best to grow of those rotations suited to combat take-all. As in the case of wheat, the variety that matures its grain early is most valuable under our climatic conditions; an oat that can do this and at the same time develop a plump grain is the ideal one for the grower.

The list of varieties presented in the accompanying tables comprises most of the oats tested by the Department from time to time, but it is not claimed that it is by any means complete. Unimportant varieties, those little known and only suited for cold countries, have been omitted. Any that have in recent years come before the public have been included, with the object of providing a guide to the farmer rather than a catalogue of all known varieties that have been imported. We cannot supply seed of these oats, except of those recommended by the Department, and we would strongly advise growers to sow quite a small patch of an introduced variety before buying a quantity. A plump good sample will not produce similar seed if the variety is unsuited to the district, and on the other hand an indifferent sample of a proved variety will often yield a good crop.

In the column indicating the season of the varieties, "E" represents early maturing, "M" midseason, and "L" signifies late ripening. The colour of the grain is in general a constant character, but Algerian, for instance, is often of a pale brown tint in warm districts and dark brown in cool ones. An oat that is called early in England or America is not usually so here. The time of maturity of each variety is stated in accordance with its behaviour when grown in this State.

Caution.—It should be understood that the list does not in any way recommend the varieties named. It merely gives general information for the benefit of farmers. For convenience, however, the names of those varieties that are recommended by the Department for various purposes are printed in black type.

VARIETIES of Oats tested in New South Wales.

Variety.	Season.	Character of— Straw.	Character of— Leaves.	Appearance of Grain.	Breeding or Origin.	Defects.	Distinguishing characters and good points.	Districts suitable.
Abed Danish Giant	L	Coarse ...	Broad ...	White, medium short.	Denmark	Too late	....	Only cold.
Abruzzes	M	....	....	....	Algeria	....	Closely resembles Algerian ...	....
Abundance... ...	L	Coarse ...	Rather broad.	White, medium short.	England...	Rather late ...	One of the best late varieties ...	Only cold.
Algerian	M	Fine ...	Not broad ...	Brown, long ...	Algeria	Sometimes lodges...	Good general purpose oat; reddish straw.	General.
Algerian Tartar ...	M	Medium coarse.	Not broad ...	Creamy, long, not stout.	Departmental crossbred (Algerian x White Tartarian).	Not so good for grain as hay.	Reddish; strong straw	General.
Argentine	E	Fine ...	Not broad ...	Brown, long, slender	South Africa	....	Resembles Algerian	Warm.
Bancroft	M	....	....	....	South Africa	....	Seems identical with Algerian ...	Warm.
Banner	L	Coarse ...	Broad ...	White, medium short.	U.S., America	Too late	....	Only cold.
Bathurst Early ...	E	Medium coarse.	Inclined to broad.	Brown, short ...	Departmental crossbred (Algerian x Carter's Cluster).	Somewhat weak straw.	Reddish straw when ripe... ...	Central West, and Riverina.
Bathurst No. 5 ...	E–M	Medium fine.	Medium broad.	Brown, medium short.	Departmental crossbred (White Ligowo x Algerian).	Stout awns ...	Does not shake; general purpose; reddish straw.	Temperate.
Belgian Black Winter.	L	Fine ...	Narrow ...	Black, fairly long .	France	Too late	Only adapted for grazing ...	....
Beseler's Prolific ...	L	Coarse ...	Broad ...	White, medium short.	England...	Too late	....	Only coldest.
Big Four	L	Coarse ...	Broad ...	White, short ...	U.S., America	Rather late ...	....	Only coldest.
Black Algerian ...	M–L	Fine ...	Not broad ...	Black, long ...	Algeria	....	Very like Algerian, but ripens later.	Temperate.
Black Bell ...	L	Medium fine.	Medium broad.	Black, medium length.	Sweden	Too late	Grazing variety	Coldest.
Black Mogul ...	L	Medium fine.	Medium broad.	Black, medium to long.	Sweden	Too late	Grazing variety	Coldest.
Blue Stem ...	...	....	....	....	....	....	Identical with Algerian	....
Boswell's Winter ...	L	Very fine	Narrow ...	Black, long, not very plump.	U.S., America	Too late	Stools heavily; a grazing oat ...	Coldest only.
Brown Calcutta ...	E–M	Fine ...	Not broad	Brown, long ...	South Australia ...	Straw weaker than Algerian; apt to lodge.	Similar to Algerian; ripens earlier	Same as Algerian.
Burt	...	....	....	....	....	....	Closely resembles Algerian ...	....
Calcutta	...	....	....	....	....	....	Same as Brown Calcutta ...	....
Cape	...	....	....	....	....	....	Same as Brown Calcutta ...	....
Carter's Royal Cluster.	L	Coarse ...	Broad ...	White, medium short.	England...	Too late	....	Only cold.
Champion	M	Medium fine.	Not broad ...	Pale yellow, short, small.	South Australia ...	Straw rather short	....	General inland.
Cowra No. 22 ...	E	Fine ...	Not broad ...	Pale dun, large ...	Departmental selection from Ruakura.	Straw slightly weak	Medium stooler; tall straw ...	Warm and coastal.

VARIETIES of Oats tested in New South Wales—*continued.*

Variety.	Season.	Character of— Straw.	Character of— Leaves.	Appearance of Grain.	Breeding or Origin.	Defects.	Distinguishing characters and good points.	Districts suitable.
Cowra No. 25	E	Fine	Not broad	Light brown, large	Departmental selection from Sunrise.	Scanty stooler	Very early; does not shake; straw reddish.	Dry and warm.
Danish Island	L	Coarse	Broad.	White, medium length.	Denmark	Too late	...	Only cold.
Defiance	L	Coarse	Broad.	White, medium length.	Europe	Too late	...	Only cold.
Dun	L	Coarse	Medium broad.	Dun, medium length.	England	Too late	...	Only cold.
Early Burt	E-M	Fine	Not broad	Yellow, long	Western Australia	...	Resembles Algerian, but earlier	General.
Early Red Texas	...	...	...	...	...	...	Very similar to Algerian	...
Fulghum	E-M	Fine	Not broad	Pale brown, medium long.	U.S., America	...	Rather like Algerian	...
Garton's	L	Coarse	Broad	White, rather short	England	Too late	...	Coldest only.
Glen Innes No. 1	M	Medium fine.	Medium broad.	Brown, medium short.	Departmental crossbred (White Ligowo x Algerian).	...	Fine awn	Temperate and cold.
Gold Rain	L	Coarse	Broad	White, medium short.	Sweden	Too late	...	Coldest only.
Guyra	E	Medium fine.	Medium broad.	Dark brown, short.	Departmental crossbred (White Ligowo x Algerian).	Coarse awn	Taller straw than Lachlan, and stools slightly more.	Temperate and cold.
Kelsall's	E	Fine	Not broad	Yellow, long	Victoria	Straw rather short for hay.	Resembles Algerian	Riverina.
Kherson	M	Fine	Medium broad.	Light yellow, medium to long, not large.	U.S., America	...	Suitable for rack hay	Temperate and cold.
Lachlan	E	Medium fine.	Medium broad.	Brown, rather short	Departmental crossbred (White Ligowo x Algerian).	Stout awns	Strong straw; reddish tint; a general purpose and grain oat.	Wheat belt generally.
Leader	L	Coarse	Broad	White, medium short.	England	Too late	...	Only cold.
Million Dollar	...	...	...	...	...	...	Same as Algerian	...
Mortgage Lifter (1).	...	...	...	...	...	...	Same as Algerian	...
Mortgage Lifter (2).	L	Coarse	Broad	White, medium length.	Western Australia (originated from Sweden).	Too late	A side oat like White Tartarian	Coldest only.
Newmarket	L	Coarse	Broad	White, medium length.	England	Too late	...	Coldest only.
"OAC 72"	L	Coarse	Broad	White, medium length.	Canada	Too late	Side oat, heavy stooler	Coldest only.
Potato	L	Coarse	Broad	White, medium length.	England	Rather too late	Hutchinson's strain about the best; grown in New England.	Cold only.
Red Rustproof	M	Fine	Not broad	Brown, medium long.	U.S., America	Straw not quite so strong as Algerian.	Resembles Algerian	General.

VARIETIES of Oats tested in New South Wales—*continued.*

Variety.	Season.	Character of— Straw.	Character of— Leaves.	Appearance of Grain.	Breeding or Origin.	Defects.	Distinguishing characters and good points.	Districts suitable.
Red Texas	...	....	....	....	....	....	Very similar to Algerian	....
Reid's New	L	Coarse	Rather broad.	White, medium length.	....	....	Much like White Tartarian, but grain somewhat shorter.	Coldest only.
Ruakura	E	Fine	Not very broad.	Dun, medium length.	New Zealand; selection from Argentine.	Straw weak; grown inland.	General purpose	Coastal.
Sensation	L	Coarse	Broad	White, medium long.	....	Too late	Compact head, tree type	Cold only.
Sixty Day	M	Fine	Medium broad.	White, medium long, not large.	U.S., America	Straw slender	Suitable for rack hay	Temperate and cold.
Skinless	L	Medium fine.	Medium narrow.	Naked, long	China	Not very productive.	Loose chaff, spreading head	Temperate.
Smyrna	E	Fine	Not broad	Brown, long and large.	U.S., America	Stools somewhat less than Algerian.	Resembles Algerian	Temperate and warm.
Sparrowbill	L	Coarse	Broad	White, quite short	Tasmania	Too late	....	Only cold.
Spooner Hart	...	....	....	....	....		Identical with Algerian	....
Starke's Hoolmaker or Hoolmarkt.	E	Fine	Not very broad.	Dun, medium length.	U.S., America	....	Loose, long, open head	Coastal and temperate.
Stable King	L	Coarse	Broad	White, medium long	Europe	Too late	....	Cold only.
Storm King	L	Very coarse.	Broad	White, rather short	Europe	Too late	....	Cold only.
Sunrise	E	Medium coarse.	Not very broad.	White, large, long	Departmental selection from Algerian.	Spare stooler	Tall straw, general purpose, rust escaping.	Warm, hot, and coastal.
Surprise	L	Coarse	Broad	White, medium short.	Europe	Too late	....	Cold only.
Tartar King	L	Very coarse.	Broad	White, medium short.	Europe	Too late	....	Cold only.
Tasmanian Giant	L	Coarse	Broad	White, medium length.	Tasmania	Rather late	Among the best of the white feed oats.	Cold only.
Victory	L	Coarse	Broad	White, medium length.	Sweden	Rather late	....	Cold only.
White Bonanza	L	Coarse	Broad	White, medium length.	U.S., America	Too late	....	Cold only.
White Horse	L	Coarse	Broad	White, medium length.	Europe	Too late	....	Cold only.
White Ligowo	L	Coarse	Broad	White, medium length.	France	Coarse awn	One of the best white oats	Cold only.
White Tartarian	L	Coarse	Broad	White, medium length.	Europe	Too late	....	Coldest.
White Tartarian	L	Medium coarse.	Medium broad.	White, long, slender	England	Hay not very palatable to stock.	Heavy cropper; side type of head.	Cold only.
Wild or Black	E	Fine, slender.	Not broad	Grey to black, and very hairy.	Europe	A persistent weed; very coarse awn and husk.	Sometimes of value as feed; a horseshoe-shaped mark at base of grain peculiar to this oat.	General.
Winter Turf	L	Very slender.	Narrow	White, medium size and length.	Europe	Very late	Heavy stooler, suited for grazing	Coldest.
Winter Turpe	...	....	....	....	U.S., America	....	Closely resembles Algerian	....

Foot-rot in Sheep.

CHARLES L. O'GORMAN, M.R.C.V.S., Government Veterinary Officer.

OWING to the occurrence of a series of dry seasons, foot-rot in sheep, at one time so prevalent in New South Wales, has greatly diminished in recent years, and in some districts it has almost disappeared. This fact illustrates strikingly the influence of the absence of moisture in arresting this disease. Unfortunately, it is the good seasons, with their rains and moisture, that are most favourable to the development of the disease, and unless considerable care in exercised a recrudescence is to be expected in the event of a return to better seasons with a more abundant rainfall.

The subject is one of considerable interest to flock-owners and some useful purpose may be served by briefly reviewing the causes, symptoms, and methods of controlling and treating this scourge to sheep, as much trouble, annoyance, and loss may be avoided by prompt and efficient action.

Causes.

For many years great controversy existed as to the cause of this disease. It is now generally recognised that there are two forms of foot-rot in sheep —(1) a simple form following on mechanical injuries, and (2) a very virulent necrotic form known as "contagious foot-rot." The former is due to infection with pus organisms which gain entrance to the tissues through injuries to the horn, such as excessive wearing away, scalding, or a breaking of the horn substance; as a rule, a few sheep only are affected.

The contagious form is due to a specific organism, the *Bacillus necrophorus,* which, when introduced, spreads rapidly through the flock, the affected animals spreading the disease by contaminating the pastures with which they are brought in contact.

Under this heading must also be considered certain conditions which facilitate infection—very potent factors, which may be regarded as accessory causes. Chief amongst these is moisture, as in wet seasons and badly-drained pastures, which bring about masceration or softening of the horn. Other predisposing conditions are accumulation of mud between the digits (which become hardened masses causing abrasions), overgrowth of the horn with incurving of the wall, long grass dragging between the digits (causing lacerations—a fruitful source of spreading infection), in a word, any condition which brings about a breach of surface or enfeeblement of the tissues.

Symptoms.

Attention is generally drawn to the disease, in the first place, by the occurrence of lameness in one or more sheep, each day adding to the number attacked. The fore-feet are most frequently affected. The lameness, which is slight at first, gradually becomes more pronounced as the disease progresses, and the affected animal lags behind the flock, rests frequently, and

will be noticed to lie about a good deal; when the fore-feet are affected it walks about grazing on its knees, but remains down when the hind feet are affected.

On an examination being made of a lame foot in the initial stages of the disease it is found hot and tender with some swelling of the coronet and between the claws; later the affected parts become red and moist, abscesses may form, or the whole of the interdigital surface may become raw and ulcerous, exuding a fluid with a most offensive odour. The inflammation extends, invading the tissues beneath the horn, which becomes detached, giving lodgment for a quantity of foul matter which has a tendency to burrow still further; the horn may peel off, or the whole hoof may become loosened and detached, exposing the sensitive vascular structures beneath, from which masses of new inflammatory growths sprout out in a fungus-like manner. In infections with the *Bacillus necrophorus* sloughs and masses of dead necrotic tissue are produced, the necrotic process excavating cavities in the inflammatory swelling and extending as far as the ligaments and joints. Owing to the pain which the animal experiences in movement rendering it difficult for it to obtain sufficient nourishment, it rapidly falls away in condition and becomes very poor. As a result of lying with its feet beneath it, the discharges contaminate the wool, and flies are attracted and further aggravate the condition; complications may then occur, and death put an end to the animal's suffering.

Such is the termination to be expected as the result of neglect. In some cases recovery with more or less deformity of the foot may take place spontaneously, but when prompt and effective treatment is adopted recovery is generally complete.

Treatment.

In order to obtain the best results treatment must be adopted early, while the disease is still in the initial stages, and before irreparable structural changes have occurred; the importance of this cannot be too greatly stressed, otherwise treatment is tedious and the results uncertain. A great variety of dressings have from time to time been advocated by various authorities. Of these the one which experience has shown to be the most reliable is the well-known stockman's standby, bluestone (copper sulphate), the antiseptic, stimulant, and astringent properties of which make it admirably suitable as a dressing for foot-rot. Used for this purpose, a solution in the proportion of 6 oz. of bluestone to 1 gallon of water is sufficient; stronger solutions are unnecessarily caustic and are apt to damage the tissues. When making the solution a wooden or enamel vessel should be used, as copper sulphate corrodes metals. The quantity of copper sulphate prescribed will dissolve in a quart of boiling water. Cold water is then added to make 1 gallon. Larger quantities in similar proportions may be used, of course. The dressing is applied by means of a brush or cotton swab, or by holding the affected foot in the liquid for two minutes. This treatment is repeated on the following day, and as often as may subsequently be required. In slight cases one or two dressings may be sufficient.

To prepare the feet for the dressing remove all accumulations of mud, &c., all overgrown, distorted, loose, and under-run portions of horn being cut carefully away. The success of the treatment depends largely upon the thoroughness and care with which this preliminary preparation of the foot is carried out. The more advanced cases with profuse granulations and abscesses require special attention. Abscesses and fistulæ must be opened and excessive granulations (proud flesh) or fungus growths removed with the knife, any bleeding being checked by a compression bandage. When much horn has been removed, the foot must be protected by a dressing of Stockholm tar. In all cases soiling of the feet by dust and mud after dressing must be avoided as far as possible.

When dealing with large numbers of sheep it will simplify matters to muster the flock and separate the sound from the affected animals, carefully examining the latter. If they are numerous it is a good plan to divide them again into two lots—those that are only slightly affected and likely to get well after one or two dressings, and the advanced cases which will require much longer treatment. The dressing may be conveniently and expeditiously carried out by means of a foot bath. This may consist of a watertight wooden trough about 10 feet long 20 inches wide and 10 inches deep. A suitable dry position should be selected for this, low hurdles should be run along each side to prevent the sheep jumping out, and pens made at each end for holding the sheep before and after the bath. A batten floor should be provided for the sheep to land on from the bath, or some other provision made to protect the feet from mud.

When required for use the trough should be filled to a depth of about 4 inches with the copper sulphate solution mentioned above. The sheep should then be passed slowly through, care being taken that they do not rush through too quickly or walk through on three legs, so that the affected foot escapes treatment. After passing through the bath they should be held in the pen for a while to allow excess solution to drain off.

After treatment the sheep should be run on to a fresh, dry, uncontaminated pasture; on no account should they return immediately to the old infected one, as some time must be allowed for it to dry and freshen up by the action of the sun. Advanced cases of the disease should be kept by themselves, so that they may be conveniently handled for further treatment. When outbreaks have occurred it is a wise precaution to pass the whole of the flock through the foot-bath before putting them on to a fresh paddock.

Precautions.

Precautions consist in avoiding those conditions which have been mentioned as accessory causes. During wet seasons remove the flock to high ground, or the best drained paddocks. When pastures are moist special vigilance is required, frequent changes of pastures being necessary. At all times avoid overstocking. When the disease is prevalent care must be exercised when purchasing sheep to be added to a healthy flock; a few days in isolated quarters before permitting them to join the main flock may prove to be time and effort well spent.

It must not be forgotten that some breeds of sheep are more predisposed to foot-rot than others. The Romney Marsh, because of the conditions under which it has been bred for generations, is the most resistant; the Merino, on the other hand, is most susceptible.

Walking the sheep over freshly-slaked lime thrown down at the entrance to the paddock tends to harden the horn and acts as a preventive.

Working up a Dairy Herd.

If I start with an average herd and a good bull, is it advisable to mate him with his own progeny, or does close breeding cause deterioration? The reply was somewhat as follows:—

The best method is to breed from the average herd, using a highly-bred bull of pure breeding with good milk records among his female relatives. Do not mate him with his own heifers, but, when a change is necessary, procure another bull of the same breed. Line-breeding can only be carried out in a herd of good outstanding qualities, and the average breeder is not advised to attempt it. Close breeding causes either improvement or deterioration according to the ability of the breeder to note any lack of type or constitution, and his skill in rectifying those defects. The herd, however, at commencement must be first-class. Close breeding has never been undertaken by this Department, it being inadvisable under ordinary conditions.—J. A. Robertson, Herdmaster.

Protecting Orchards from Frost with Smudge-pots.

In districts subject to frosts it is now fully recognised by orchardists in California that a good "smudging" plant is an absolute necessity, and any cost in this direction is looked upon as a sound investment and an insurance of the crop. The outfit consists of a number of black iron pots, shaped like ordinary flower pots, supplied with loose-fitting lids. A cross made of strips about 1 inch wide is riveted inside each, about ¾ inch from the top.

The pots are made in two sizes, namely 5 quarts and 7 quarts. They are filled with a crude cheap oil, and placed under the trees. The number of pots used per acre depends upon the severity of the frosts in a particular district; for instance, where not more than 6 degrees of frost are usually recorded twenty pots per acre would be sufficient; for 8 degrees, thirty pots; and for 10 or more degrees, up to forty pots per acre.

A close watch is kept on the temperature, and when it begins to freeze the pots are placed in the middle of the rows of trees and lighted. The flame striking the cross-piece in the pot throws up a dense smoke, which is the object aimed at. As the oil burns down the pots are refilled, and when the danger is passed the lids are dropped on and the flames extinguished. The pots are then put under the trees, out of the way of cultivation, and during the summer are stored in any convenient place.—Extract from report by Mr. J. Brady, Cannery Superintendent, Water Conservation and Irrigation Committee.

The Culture of Sugar Cane in New South Wales.

[Concluded from page 184.]

A. H. HAYWOOD, Manager, Wollongbar Experiment Farm.

THE diseases to which sugar-cane is liable in this State are not numerous, but, as has been indicated in the earlier articles, they have had a marked effect on the areas devoted to the crop and on the profits derived by the growers. As with many other classes of produce, the cane-farmer is disposed to regard somewhat lightly the appearance of disease until the effects have become manifest and serious loss has been entailed. Then there is a hurried resort to some new variety, and perhaps an injured appeal to the Department of Agriculture for assistance.

Incidental reference has already been made to the influence of clean cultivation, combined with judicious selection of the variety and the seed as means of prevention, and it can only be repeated now that these measures—cheaper than all others—are also the most effective. The grower must, however, first know how to recognise each disease and how its spread may be prevented.

For the following notes on the four diseases most common in New South Wales, I am indebted to Mr. D. S. North, plant pathologist to the Colonial Sugar Refining Company, Limited, who has done valuable work in this sphere.

Gumming.

Gumming is most surely detected by the tiny yellow spots of gum which ooze out on to the cut ends of the canes. These spots quickly appear without treatment in severe cases, but in mild cases suspected canes freshly cut into short lengths should be enclosed in a tight can (*e.g.*, a billy-can) to sweat for two or three hours before looking for the gum spots.

At quite an early stage of gumming, peculiar narrow streaks, spotted with yellow and orange, turning into withered streaks towards the leaf-tips, appear on some of the older leaves. Special attention should be given to these leaf-streaks, because frequently they will draw attention to the presence of gumming in an otherwise healthy-looking field of cane. They may even be found before it is possible to detect any gum-spots, although these can usually be obtained eventually by choosing and sweating a number of the most likely-looking stalks.

In advanced stages, numerous signs of ill-health appear, including white leaves, dead and dying canes, gum cavities in the stalks near the tops, &c., &c.

All of the present approved varieties are likely to be attacked, although they are resistant compared to some grown in the past. Malabar is the most highly resistant, and therefore the safest variety to plant on farms where this disease is present. No immune variety is known.

Leaf-scald.

Two distinct phases occur in this disease. In one phase, whole stalks, sometimes whole stools, suddenly wither and die. In the other, white or withered streaks appear in the leaves and all the buds on the stalk sprout into side-shoots; the leaves sometimes turn partly white, and show a tendency to wilt and to wither at the tips. Either one of these phases may occur without the other, or both may appear together in the same stool.

The peculiar streaks in the leaves provide the best symptom for its definite recognition. They are usually straight, narrow, even, well-defined, whitish streaks, one or several in a leaf, and may either run throughout the entire length of the leaf-blade and leaf-sheath, or only part of this distance. Towards the leaf-tip, they sooner or later turn into a withered streak. The discovery of a streak in one single leaf is sufficient to diagnose the disease.

Where the withering phase occurs alone, sometimes no characteristic symptom indicating leaf-scald as the cause of death can be discovered. But frequently, peculiar small, sickly shoots (suckers) bearing the typical leaf-streaks may be found by searching at the base of the stool.

In the other phase, the leaf-streaks may readily be found, both in the ordinary leaves of the stalk and in the leaves of the side-shoots and the small suckers.

Of present approved varieties, Mahona alone becomes badly affected; N.G. 16 may be attacked in isolated stools, as also may most other varieties, but to a still smaller degree.

Fiji Disease.

Fiji disease shows itself in short, stunted growth with small, deformed, wrinkled leaves, on some of which scorched patches occur. Later, the buds on the stalks sprout and numerous small suckers spring from the ground.

Peculiar galls are found on the underneath side of the leaves, in the form of small, elongated lumps or ridges, both on the midribs and on the leaf-blades. These galls provide the best means for diagnosing the disease, especially as they may be found in its early stages while the cane appears otherwise healthy, as well as in all later stages.

Where it has gained a good hold, this disease has proved difficult to deal with, because all varieties are attacked by it. Mahona and Badila have proved to be rather more resistant than D 1135, N.G. 16, and most of the other varieties grown.

Yellow Stripe Disease.

This is also known as "Mottling" or "Mosaic" disease. It is recognisable by a peculiar mottling of the leaves, by which their green colouring is reduced to a lighter, more yellowish tint. In the more advanced stages, similar mottled markings may also be seen on the rind of the stalks.

These are the only evidences of disease to be found. Far from being destroyed, affected canes appear to the casual observer to have nothing wrong with them. Yet this disease causes severe losses of crop by reducing the vigour of growth, producing thinner, shorter stalks, fewer stalks per stool and generally a much lower weight per acre of cane. Further, its effects are cumulative, becoming more and more severe with each successive planting of diseased stock.

Many cases of the so-called deterioration or "running out" of varieties have undoubtedly been due to this disease.

All of the present approved varieties are liable to its attack. Of these, N.G. 16 and Mahona appear most resistant, while Innis 131, Malabar, and 1900 Seedling are rather susceptible.

Controlling these Diseases.

As already stated, clean cultivation and the planting only of healthy cane are the methods of control that the farmer should regard as most practical and effective. For the following summary of these methods in actual practice I am further indebted to Mr. D. S. North:—

1. Selection of healthy cane for planting.
2. Eradication of disease in the young crops.
3. Dealing with badly diseased crops.
4. Avoidance of knife infection.
5. Attention to drainage.

1. *Selection of Healthy Cane for Planting.*—This is of first importance, because, in the case of these four diseases, infected cuttings—if they grow—invariably produce diseased stools.

It has been found that a portion of the cuttings may prove diseased when they are taken from the healthy-looking stools in fields where disease is present. This is especially the case with gumming, leaf-scald, and Fiji disease. When healthy canes become infected by these diseases, they undergo a prolonged period of incubation, varying from a few weeks to twelve months or more, before any decided symptoms appear.

On this account, selection of healthy plants becomes more a matter of selecting healthy fields than of excluding diseased cuttings or stools.

It has been found unsafe to take plants from fields in which even traces of either gumming or leaf-scald can be discovered. Where not objectionable for other reasons, the planting of clean plants of a resistant variety, such as Malabar, on farms where gumming occurs, or any variety other than Mahona in the case of leaf-scald, is the safest course, for this also minimises the risk of the disease spreading to the newly-planted clean field from an adjoining diseased block.

In the case of Fiji disease we have no highly resistant varieties from which much aid may be expected. But selection of the cleanest fields, followed by careful exclusion of any diseased stools in those fields, has proved adequate for its control, without a change of variety.

Yellow stripe disease, on the other hand, has a short incubation period of two to three weeks, and is infectious at certain seasons only. Healthy plants

may therefore be selected from diseased fields without undue risk being incurred, and change of variety on its account is not necessary.

2. *Eradication of Disease in the Young Crops.*—It is found in practice that odd diseased cuttings sometimes creep in in spite of every care being taken in selection of plants.

As most of these usually develop definite symptoms of disease during their first three to four months growth, they can be detected and removed, and their places filled with healthy plants at little expense, provided that only a small number be present.

This method of "cleaning up," to supplement selection of plants, is especially useful with Fiji disease.

When cultivation is completed and the cane laid by, further eradication becomes laborious, and usually does not pay. If further diseased stools appear, they may be dealt with when cultivating the young ratoons after the plant crop has been cut for the mill.

3. *Dealing with Badly Diseased Crops.*—Where the proportion of disease is too high for the eradication of individual diseased stools, the whole crop should be ploughed out as soon as possible, although it usually pays to leave it until cut for the mill. Its further ratooning would usually be undesirable, even though a payable crop might be expected, because the crop would breed infection for dissemination to any healthy cane in the vicinity.

4. *Avoidance of Knife Infection.*—It has been shown by careful trial, in the case of both gumming and leaf-scald, that cuttings from healthy plants may be infected by being cut with a cane knife previously used to cut diseased cane.

The risk may readily be avoided by disinfecting the cane knives while in use, by dipping them into disinfectant solution or into boiling water, on the principle of the surgeon who sterilises his knives to prevent blood poisoning.

Disinfection of knives is of most importance when stalks are being cut into cuttings, but it should also be used whenever cutting cane which it is intended to ratoon, on farms where even traces of these diseases are present.

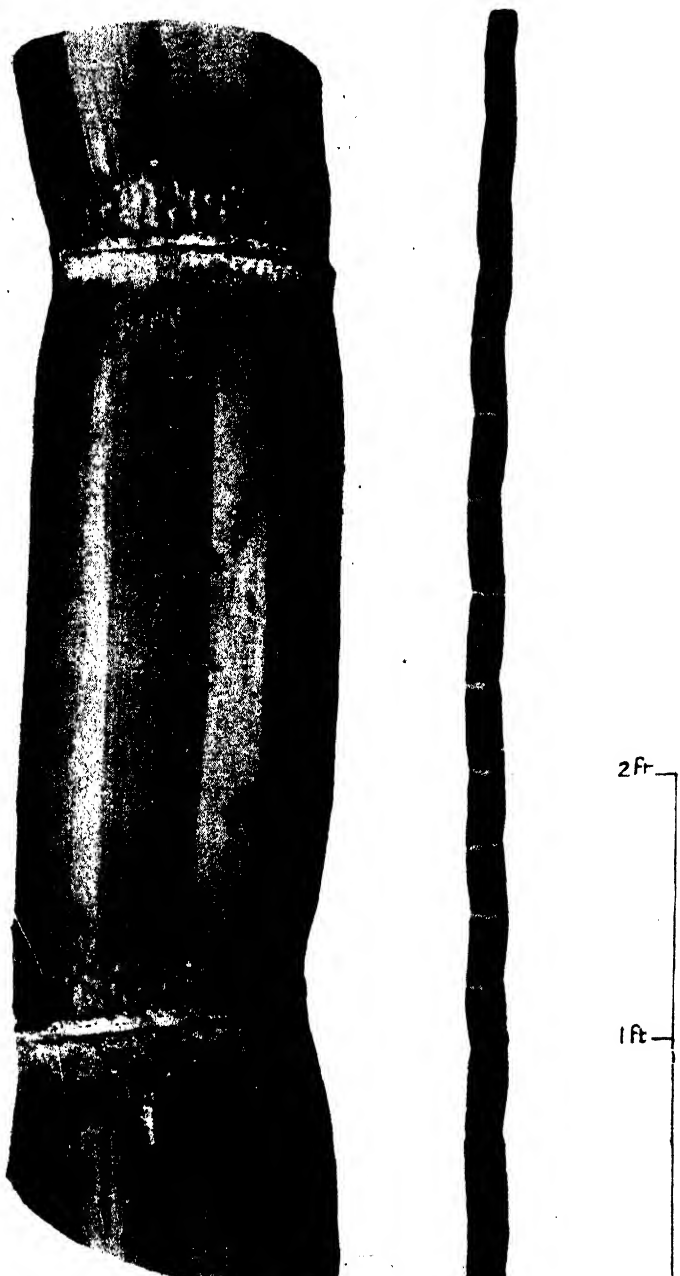
5. *Attention to Drainage.*—Defective drainage favours diseases generally. This is especially the case with gumming, which may spread with great rapidity and kill most of the cane on badly-drained areas, whereas it makes little or no headway where drainage is really good.

To Make Charcoal.

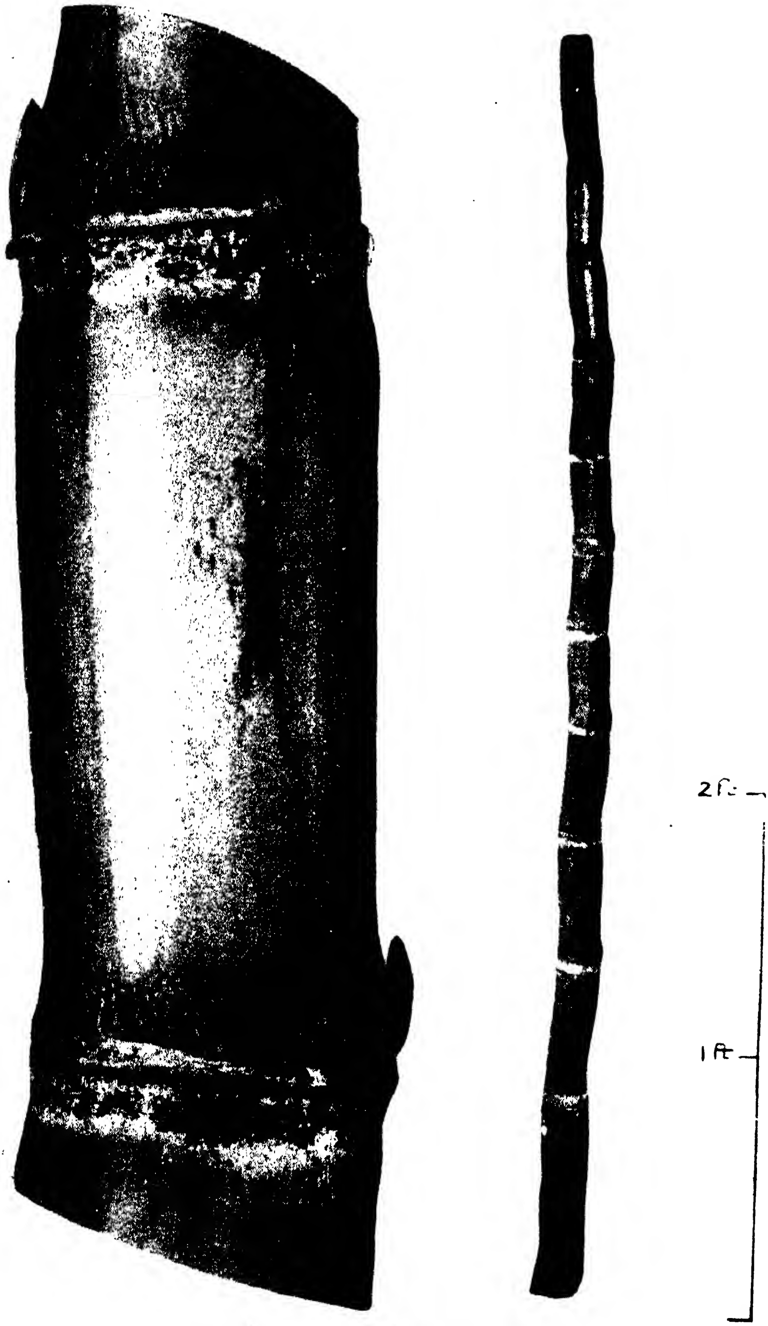
Dead, dry wood is cut into convenient lengths, placed in a stack on end, or in a large basin dug in the ground, and set alight. When well incandescent, and just before the wood is falling to pieces, scatter the stack about, or put out by pouring on water. Any wood not properly charred can be used in the next burning.

There is another method of baking in a retort, but the above is recommended to farmers as cheaper, simpler, and quite as efficient. When cool, the charcoal is collected, bagged, and stored in a dry place.—C. W. Brebner, Engineer, Hawkesbury Agricultural College.

Louisiana 511 Sugar Cane.



New Guinea No. 111 Sugar Cane.



New Guinea 117 Sugar Cane.

Plot of Early Barletta Onions at Taree Estate, on the Manning.

Section of a row of Early Barlettas

The bulbs are nearing maturity.

Farmers' Experiment Plots.

Onion Trials on the Manning River, 1920–21.

J. M. PITT, Assistant Inspector of Agriculture.

The onion probably ranks second in importance to the potato as an old and widely-used root crop. In spite of its somewhat strong and unpleasant odour rendering it obnoxious to many people, it is found in the majority of homes, where its uses—uncooked, cooked, or as a flavouring agent in many "made-up" dishes—are well known. Further, it is credited with valuable medicinal qualities. Like the potato, the onion is available in greater or less quantities throughout the year, many varieties being admirably suitable for storage purposes.

While it is recognised that the cooler districts of the State, notably the southern, central, and northern tablelands, produce onions of the best quality, still there are portions of the warmer districts—the fertile areas bordering the rivers of the central coast, for instance—where highly profitable yields, and onions of fine type, have been grown successfully for many years. It seems remarkable that, with a crop adapting itself to a wide range of climes and soils, only such a limited area is sown annually in New South Wales. During the year 1918–19, the last period for which complete statistics are available, 335 acres were sown (this being a fair average), yielding 1,045 tons, which is only a fraction of the demand. The central coastal districts averaged approximately 4½ tons per acre for 60 odd acres, while the tablelands yielded 2½ tons per acre. Locally grown onions were only available on the wholesale market from November to May (inclusive), and in limited quantities, the bulk of our requirements coming from overseas (New Zealand) and from Victoria and Tasmania, Victoria being by far the largest supplier.

The following tables contain interesting figures relative to the wholesale prices (per ton) in Sydney for 1918–19 and the source of supply:—

Where Grown.	July.	August.	September.	October.	November.	December.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
New South Wales..	Nil.	Nil.	Nil.	Nil.	14 15 3	12 13 3
Victoria	15 18 6	18 10 3	25 13 3	33 12 6	21 2 9	12 13 9

Where Grown.	January.	February.	March.	April	May.	June.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
New South Wales..	12 2 0	15 11 3	13 13 3	13 15 0	15 15 0	Nil.
Victoria	12 5 0	15 10 0	14 2 6	14 2 6	15 4 3	16 12 3

It will be seen that the price of locally grown onions averaged approximately £13 17s. 10d. per ton, which for the central coastal areas at 4½ tons per acre would amount to over £60 per acre—a return that perhaps exceeds that obtained from any other commercial crop.

Farmers on the whole shun onion-growing, either through prejudice or dislike for pursuits requiring a little extra care or constant attention, or else they have tried and failed, and have then drifted into the channels which, if not quite as remunerative, pay well enough for the amount of energy expended.

In conjunction with Mr. R. Dyball, junior, the Department has just conducted a trial with a number of varieties on his farm, Taree Estate. To add further interest to the experiment, a section of the crop was irrigated by means of a Nunan spray system. That the application of water by artificial means during a dry season had a most beneficial result will be seen from the table of results below.

The Season.

Ideal conditions prevailed during July, continuous showers giving the young plants an assured foothold in the permanent bed. August was cold, dry, and windy; a few useful showers fell during September and October. The first irrigation was given in the middle of October, and the last in November. Ample rain fell from then until maturity. It will be noticed that the difference in yields between the irrigated and non-irrigated sections was greater in the Barlettas—an early maturing variety—than in the Ailsa Craigs, the subsequent rains being of great benefit to the later maturing variety. The rainfall over the growing period was as follows:—July, 292 points, August 10, September 122, October 75, November 225, December 433, Total, 1,157 points.

Method of Sowing.

Success depends largely on whether the crop is to be cared for, or allowed to look after itself. A good beginning can be made by first raising seedlings in a seed patch, and afterwards transplanting into the main bed. Sowing the seed broadcast, or in rows in the permanent bed, are methods having very little to recommend them, especially where the areas are weed-infested. Weed-seeds germinate quicker and grow more rapidly than the onion, and are its greatest curse. The small seed-patch can be more easily tended to, a better germination results, weaklings can be discarded, the main bed is available for longer preparation, transplanting can be done in suitable weather, a better stand is assured, the bed can be more easily kept clean, the bulbs mature more evenly and earlier; and above all, yields are greatly increased. The task of planting a large area in rows 3 feet apart, plants 4 to 5 inches in the row, seems rather strenuous, but the hand work necessary when onions are sown by other methods has to a great extent been eliminated by the planting out method; seven or eight thousand plants can be planted out per day quite easily.

The Seed-bed.

Seed of the seven varieties were sown in a well prepared plot at the end of March. The site (selected for its freedom from weeds) was worked into a fine tilth by hand-digging, the surface inch or so being kept loose and the sub-surface firm. After sprinkling the seed evenly, the plot was watered carefully with a can and fine rose attachment. This procedure washes the soil lightly around the seed, providing ample covering. The secret of a good germination is to cover the seed lightly; the young shoots are weakly, and cannot push through a heavy covering. Care must also be taken to keep the soil moist (not wet) by watering at intervals. A covering made of hessian carried 12 or 18 inches above the bed on a frame keeps an even moisture and temperature, but must be removed as soon as the young plants are noticeable, otherwise they become drawn and weak. Germination was excellent. When necessary the patch was weeded and the weaklings thinned out.

Transplanting.

The plants were sufficiently advanced to transplant in July, being then about the thickness of lead pencils. Barlettas were transplanted first, followed by Longkeeping Spanish, Tripoli, Hunter Rivers, Silver King, Giant Roccas, finishing with Ailsa Craig.

No trouble was spared in previously preparing a good plot, as onions, like other farm crops, will only yield their best when treated properly. Following a crop of potatoes, the land was disc-ploughed, fallowed, and ploughed twice more, followed by several harrowings to bring it to a fine tilth. Shallow drills—really only lines—were marked out 3 feet apart. The young plants were bunched in boxes, part of the straggling top growth removed, leaving 4 inches of a sturdy plant, and the roots were nipped off to within $\frac{3}{4}$ inch of the bulb. The onion, being a hardy individual, can stand such treatment, and the operation expedites transplanting and does away with the possibility of the plant being pulled out by cultivation. Great care must be taken only to firm the roots and a very small portion of the bulbs in the soil, just enough to hold the plant firm and upright. The bulbs will not reach their maximum size nor thrive nearly as well if planted too deeply.

After Cultivation.

Weeds usually do not put in an appearance until the spring months. By this time the young plants have become firmly established, and can be worked amongst by hoe or horse without fear of damage. The crop was twice hoed and thrice cultivated to clean out the "middles" and restore the soil mulch after irrigation.

Harvesting.

Onions are ready to harvest when the tops begin to wither, indicated by the plants leaning over. This is caused by the substance being absorbed from the stalk by the bulb. Mr. Dyball pulls and leaves the onions in windrows in the field for a day or two to cure, or else lays them on the floor of the shed for the same purpose. It is advisable not to leave the crop

too long in the field after maturing, otherwise second growth is encouraged, and this spoils the keeping qualities of the onion. The bulbs were disposed of locally, Early Barlettas realizing 3d. per lb., and the midseason and late varieties 2½d. and 2d.

Varieties.

White Early Barlettas.—A very early maturing (November), white-skinned, flat onion, many bulbs growing to 6 inches in diameter and weighing over 1 lb. Excellent flavour and mild; not a good keeper.

Tripoli.—A white-skinned variety, maturing a little later than Barletta; bulbs medium size. Flavour good; not a good keeper.

Giant Rocca.—A reddish brown, globular-shaped onion, growing to a fair size, and maturing about the same time as Tripoli. Flavour good and mild; not a good keeper.

Silver King.—Maturing about the same time as Rocca, an onion somewhat similar in shape to the Barletta, only deeper; skin pink-tinged. A mild-flavoured, good eating variety; poor keeper.

Ailsa Craig.—A pale-brown, globular-shaped onion of excellent quality, large size, and attractive appearance; fairly firm. Flavour mild and good: matures in January (late); fairly good keeper.

Hunter River Brown Spanish.—Seed sown rather too early; broke into head too soon. Harvested simultaneously with the main Barlettas; brown skinned, globular shaped, firm. Good flavour, rather hot and strong; excellent keeper.

Long-keeping Brown Spanish.—A brown-skinned Spanish onion of good quality, very similar to the Hunter River type; matured about the same time as Giant Roccas (December); firm. Flavour good, hot; exceptionally good keeper.

YIELDS of Varieties of Onions.

Variety.	Irrigated Section.				Non-irrigated Section.			
	t.	c.	q.	lb.	t.	c.	q.	lb.
White Early Barletta	7	13	0	24	1	19	1	4
Ailsa Craig	7	7	1	8	4	4	1	24
Hunter River Brown Spanish...	6	8	2	18	2	10	0	10
Long-keeping Brown Spanish ...	6	4	2	26	2	7	0	16
Giant Rocca	5	11	3	24	2	2	0	26
Silver King	5	6	0	8	2	1	1	0
Tripoli	3	2	3	12	1	17	0	8

No fertiliser was used.

"Look at the work there is in it—keeping the stuff head down after it is cut so that the sap won't run out."

The remark was made by way of objection to the trouble involved in making silage. What answering echo it found in the minds of the hearers history does not relate, but it is perhaps necessary to add that the statement was made in all seriousness.

Tick Paralysis.

SYDNEY DODD, D.V.Sc., F.R.C.V.S., Lecturer in Veterinary Pathology and Bacteriology, University of Sydney.

ALONG the whole of the eastern coast of Australia a form of paralysis, accompanied by other symptoms, most common in the domesticated animals but occasionally reported in human beings, is well known; popular as well as professional opinion is unanimous in ascribing it to the bite of a tick, known as the "scrub tick." There is, however, more than one genus of tick, and several species inhabit the scrubs or thickly wooded parts of eastern Australia, and the name "scrub tick" is applied popularly to any of them, and, as a rule, indifferently.

Among the so-called scrub ticks are those which most stock men differentiate under the name of "bottle tick," on account of the large size which the fully engorged female attains.

The bottle tick appears to be either an *Amblyomma* or *Hyalomma.* In this connection Mr. L. Harrison, B.Sc., Lecturer in Zoölogy at the University of Sydney, informs me that he has examined numerous ticks from dogs in the neighbourhood of Sydney, and they have all been *Ixodes holocyclus.*

In Queensland and a small part of northern New South Wales, the cattle tick, *Margaropus annulatus*, is more or less prevalent, but popular view does not include this among the "scrub ticks." No scientific determination of the ticks removed from human beings or animals affected with tick paralysis in Australia appears hitherto to have been made, the nearest being such remarks as "it was almost certain," or "it was probably" a particular species, viz., *Ixodes holocyclus.* With regard to the experimental proof as to which, if any, of the so-called scrub ticks in this country is the cause of the undoubted cases of paralysis in human beings and animals, and so often fatal in the young of the latter, I have been unable to find any published record of any experiments, whether negative or positive. I have been informed that such experiments have been attempted at various times, but as the results have not been published the conclusion to be arrived at is that they were unsuccessful.

Tick paralysis is most commonly seen at that period of the year when ticks are most prevalent in the coastal scrubs, viz., spring and summer. In the more northern parts of eastern Australia, however, where the winters are seldom cold enough to arrest the life cycle of ticks in general, it may occur at any period of the year.

In susceptible individuals one tick is quite sufficient to give rise to very grave symptoms, and even death. The younger the animal the less favourable the prognosis.

As already stated, both human beings and animals may be affected, but the susceptible period appears to be during the early life of any particular

species. I have not heard of an authenticated case in adult human beings, and only a few have been related to me in adult animals. In these latter cases the evidence was so circumstantial that it appears reasonable to conclude that adult animals are occasionally affected. I have not obtained any evidence that sheep are affected, although these appear to be the animals most commonly suffering in South Africa and British Columbia. As, however, practically no sheep are bred on the coastal scrub areas of eastern Australia, although a fair number are brought in from time to time for food purposes, this want of evidence may have no significance.

Most of the cases narrated to me of tick paralysis in adult animals, viz., cattle, horses, and dogs, have been where the animal has been heavily infested with scrub ticks. No deaths occurred. Possibly these were cases of massive intoxication. It is generally considered that immunity in adult animals is produced by previous intoxication. Whilst it is true that immunity, even in the young, can be produced in this manner, it is highly probable that the individual becomes naturally less susceptible to the effects of the tick with advancing age, independently of prior infestation.

Animals indigenous to the country appear to be naturally immune. This, however, requires to be experimentally tested, for the opinion may be based upon incomplete evidence. It is true that apparently no one has seen a wild animal affected with tick paralysis, even although various of the scrub ticks have been found on them, but in view of the fact that no characteristic lesions or causal organisms have been found in the disease, that the condition cannot be transmitted artificially (*vide* results of experiments to be described), and also that the invariable desire of wild animals when ill is to avoid the neighbourhood of other beings, human or otherwise, it is obvious that the view as to the immunity of young indigenous animals is not based upon an unassailable foundation. Nevertheless, I believe it will be found that they do possess some, if not an absolute immunity, even of an hereditary nature. The domesticated animals in Australia are all comparatively newcomers to the country, and therefore hereditary immunity has not had time to develop in them. Another hypothesis occurring to my mind is that native indigenous animals may have acquired immunity during the course of their existence by one or more tick infestations, the highly susceptible animals dying when very young.

Symptoms of Tick Paralysis in Animals.

The earliest sign is loss of appetite and slight dulness, as a rule followed by occasional acts of vomition. Later slight inco-ördination of the hind extremities is seen. This gradually increases in severity until the whole of the hindquarters are paralysed. The paralysis then rapidly extends forward until the animal is quite unable to use any of its limbs, and then lies inert. Occasionally convulsions may occur, but are by no means the rule. The paralysis appears to be entirely a motor one—that is, it does not affect the nerves of sense. Food is refused altogether, but vomiting is frequent, the vomit now being merely a bile-stained mucous. There is no increase in the

body temperature. The pulse does not appear to be greatly affected, but respirations are often of the Cheyne-Stokes type. Finally, if the issue be a fatal one, a state of coma sets in, and the animal dies from respiratory failure. Recoveries may take place in the early stages of the disease, but when the paralysis has become general death nearly always ensues. The outlook is more favourable if the tick is removed before the condition has become established.

It is the popular view that paralytic symptoms appear soon after the tick has attached itself. This is an error and arises mainly because the owner of the animal does not observe the tick until the host begins to show unmistakeable signs of illness ; when, knowing the usual symptoms, the owner searches for the offender, which, when found, is usually, if not always, in an almost fully engorged condition. If the tick is removed soon after it has become attached paralysis does not ensue. This I have verified in a number of cases where recently-attached ticks have been removed from young dogs without any ill results following, save for some local inflammation due in most cases to the head of the tick being left behind in the skin.

Until the experiments were conducted by the writer nothing definite was known concerning the length of time taken for symptoms in animals in this country to set in after the attachment of the tick. The writer has seen a number of naturally occurring cases of tick paralysis, but they have nearly all been in an advanced stage of the disease, consequently one could only estimate how long the tick had been on.

The condition is also seen in foals, calves, and cats, the symptoms resembling those in dogs, save that with the exception of the latter, vomition is absent. It is said that young pigs are also affected. Probably this is correct, but I am of opinion that a number of reputed cases of tick paralysis in these animals are not due to ticks, but are rather that form of paresis so very common in young pigs everywhere, and due to other causes.

Although, no doubt, numerous *post mortem* examinations of animals dead from tick paralysis in Australia have been made, there are no records of such. Prior experimental work on tick paralysis in British Columbia, due to *dermacentor venustus*, has been successfully carried out by Hadwen and Nuttall (7 and 8). The present article only deals with the condition in Australia.

Historical.

The records of tick paralysis in Australia are not very numerous, and mainly relate to the condition as it occurs in human beings. Bancroft's is the only article I have seen describing the clinical symptoms in the lower animals, and this relates to dogs. Occasionally a paragraph has appeared in the various State *Agricultural Gazettes*, giving advice as to treatment of animals affected with tick paralysis, but nothing further.

1.—The first record of tick paralysis is by Bancroft, in 1884. He states that the tick of the Queensland scrub or thickly wooded districts is very poisonous to introduced animals, and that cats and dogs are frequently killed by it,

although native animals appear to escape injury; that the tick generally attaches itself about the neck and ears of dogs and about the neck, groin, and armpit in man; that the results on dogs, particularly the long-haired breeds, and cats are more serious than in human beings; and that if the ticks are not removed in the course of a few days death may be expected. He never saw a puppy recover after symptoms had become established.

He describes the symptoms in full-grown strong dogs, as follows: In two or three days after the attachment of the tick the dog begins to look weary Food is refused and, soon after, drink. The animal lies down in a place where it can remain undisturbed. Pups travel away and are rarely again found alive. Shortly after, weakness in the hind legs is observed, and in about five days from the attachment of the tick the animal becomes unable to walk, and may at times be seen to be timid and delirious. On attempting to rise up on his fore legs he may fall over insensible. In a few minutes he recovers consciousness. The lips are pale, the heart can scarcely be felt to beat, and the condition of fainting is clearly noticeable. There is great reluctance to take food or drink, and forcible feeding brings on a fainting attack. In a few days at the furthest he dies during an attack Old dogs live much longer than puppies, and if the tick has been removed early, recovery may be hoped for.

The only cat he had seen affected lay unable to walk for a week. She was forcibly fed with milk during the time and made a slow recovery. No suggestion is made as to the particular tick implicated, which, considering the period when the article was written, is not to be wondered at.

2.—The next reference to tick paralysis is made by Professor Sir T. P. Anderson Stuart in his Presidential address in 1894 to the Royal Society of New South Wales. He states that he had collected records from a number of medical practitioners concerning the effects of tick bites on animals, and summarises the accounts of about one hundred cases in dogs, giving the clinical symptoms. It may be noted that no indication is given in the address as to the species or genus of the particular tick, but he remarks that there are apparently different ticks, some harmless, and others very venomous.

The portion of the address relating to tick paralysis is as follows:—"Young animals are particularly susceptible At first there is moping, hot nose, and gradually-increasing muscular weakness, first in the hind limbs and then in the fore limbs, neck, and muscles of respiration. Obstinate constipation and retention of urine. Epileptiform attacks or prolonged convulsions may usher in a fatal issue. Or there may be no convulsions, and death ensues from heart failure, the pulse having been flickering, or from respiratory failure. Peripheral nerve paralyses have been seen during convalescence. One attack confers immunity, and in some districts where ticks abound dogs may be rendered immune by allowing the tick to remain on the animal until the first symptoms appear, which may be in a few hours. [*Note.*—He does not say whether this means from the time that the tick has first attached itself, or from the time the tick is first detected.] On recovery, the process is repeated once or twice, the dog then being protected."

3.—In 1912, Cleland, in a general article, makes reference to human infestation by ticks. Bancroft and Stuart are quoted, and he then refers in detail to two clinical cases diagnosed as tick paralysis in human beings, observed by two medical practitioners—the first in a child, with fatal results, and the other presumably in an adult, ending in recovery.

The points to be noted in the first case are—(*a*) The species of tick was not ascertained, but was guessed at, the remark being made that "the tick was almost certainly *Ixodes holocyclus*." The tick was removed and crushed under foot without examination. (*b*) The tick was called by the parent a "bottle tick". Now the popular name "bottle tick" is usually applied to a different genus than the *Ixodes*. (*c*) The rapidity of the onset of symptoms. These were stated to have set in within a few hours from the supposed time of attachment of the tick. (*d*) The size of the tick on the supposed second day of its attachment, viz., ½ inch x ⅜ inch.

Remarks *c* and *d* would appear to indicate that the tick had really attached itself some few days prior to the assumed period.

With regard to the second case, this is one in which the individual (an adult) was heavily infested with ticks (species not mentioned). About 200 were removed from various parts of the body. Within an hour after the ticks had attached themselves symptoms of faintness were noticed. Within four hours he showed extreme collapse, and weak cardiac action with syncope. There was no local irritation. The patient was ill for a week with cardiac symptoms but no paralysis.

Here one has to note the extraordinary rapidity with which symptoms set in. viz., one hour after the attachment of the ticks. It might be said that this was a case of mass intoxication, but could it not rather have been due to mental influence, especially if the patient knew, which was very probable, of the sinister reputation of scrub ticks?

4.—In 1913, Eaton described a case of tick paralysis in a child. It is the most complete description of the clinical symptoms in the human being as it occurs in Australia that I have seen, and they have so great a resemblance of those in the lower animals that it is reproduced here almost *verbatim*, only non-material parts being omitted.

"L.A.B., a girl of 4½ years, was brought to me on 3rd November last . . . with a statement by her father that she was paralysed from the bite of a tick. The patient had been in good health until the day prior to my first seeing her. On that morning, however, she took an unusually small breakfast and would take no food from then on. In the early part of the afternoon of that day she became restless, and about 4 o'clock it was noticed that she was unsteady on her feet. Having decided to put her to bed, the mother undressed her, and in doing so discovered a tick on the back of the right shoulder. Its presence had caused little or no discomfort and was quite unsuspected. The body of the tick was cut off, leaving the head and mouth parts embedded under the skin.

"The child's father, who was an intelligent bushman, described the parasite as a scrub tick, such as is commonly found on dogs. He said it was of a

slate grey colour, and was flatter than the cattle tick (*Margaropus annulatus*). The foremost pair of walking limbs were much longer than those of the latter species. The body was about three-eighths of an inch long by about a quarter of an inch in breadth, this being about the average size at full development. I was unable to get more precise information than this, but the tick was almost certainly *Ixodes ricinus* or *Ixodes holocyclus.* The tick was cut off. . . .

"About 7 p.m., the patient vomited, and for the next couple of hours seemed more comfortable. During the remainder of the night, however, she was very restless and slept in short troubled spells, a total of only two hours. The bowels moved twice in the night, the motions being of a brown colour and of a semi-solid consistency.

"*Second day.*—In the morning the child vomited again three or four times, It was found now that she could not stand, and she appeared to the parents very ill. About mid-day the patient was sent to see me. . . .

" . . . Shortly before 3 o'clock she drank a few spoonfuls of milk, the first substance she had swallowed for thirty hours. . . . This abstinence from fluids is the more remarkable in consideration that the weather was very hot, that the patient had made a long journey in an open vehicle, and that she had vomited half a dozen times in the period.

"When I saw the child at 3 o'clock she was in a state bordering on delirium, but sufficiently conscious to be annoyed on examination. The temperature was 101·4 deg. in the axilla, and the pulse rate was 132. . . . Respirations numbered 36 per minute; they were short, shallow and jerky, and performed for the most part by the muscles of forced breathing. The skin was dry except for slight perspiration of the scalp. The eyes were somewhat glazed; the lids were drooped, but were not quite closed; the pupils were dilated and inactive to the stimulus of light and to that of pilocarpine. . . . The tongue was covered with a thin white fur and was moderately dry. The muscles of the legs and thighs were quite flaccid, and the lower limbs motionless save for movement which could still be made at the hip joints. The arm muscles could be moved, but with very little force, and those of the forearms were inactive. Knee jerks could not be obtained, nor could the wrist jerks, or the normal or other plantar reflexes. Owing to delirium, the sensations could not be estimated beyond that signs of annoyance were evident when stimuli of pain or tickling were applied to any part, either of body or limbs. . . . Over the lower part of the right scapula there was a bright pink patch about the size of a penny, neither raised nor indurated, and in the centre of this was a purplish-black spot quarter of an inch in diameter. In the middle of the spot was an aperture somewhat less than a pin's head in size, and through this one could see a greenish-grey body, which grated with a stony hardness against the point of a knife. A minute droplet of pus was expressed from the aperture. . . . The object felt with the knife, evidently the head and chitinous mouth parts of the tick, could not be removed without breaking into fragments. . . .

"*Third Day.*—During the next twenty-four hours the bowels moved nine times, the motions being liquid and bile-stained, and containing a considerable quantity of mucous. There was no evidence of abdominal pain, however, and there had been no more vomiting. Sleep had been moderately good. By this time the temperature had fallen to normal, breathing was deeper and easier; the mental state had cleared, although there was still undue irritability; the appearance of the face was nearly normal, and the child now took drinks of milk freely. There was no sign of return of voluntary movement to the legs, but the muscles were not so limp. The strength of the arms had improved, and the fingers could be moved, but not even such an object as a bunch of keys could be securely held in the hands. The pupils were still enlarged . . . the eyes were moved with apparently normal freedom. Acuteness of vision was not reduced, but accommodation was paralysed. A rough general test was made of the senses of contact, temperature and pain, but no abnormality was found. There was no notable feature in the urine."

"*Fourth Day.*—By the next day, the fourth since the onset of symptoms, the knee jerks were both obtainable but deficiently. The child could stand, and even walk a few steps with support. . . . Diarrhœa still continued, but was less severe."

"*Fifth Day.*—On the fifth day the patient could walk without support, but the gait was knock-kneed, so that each leg was brought more directly under the weight of the body. In walking, no attempt was made to rise on the ball of the foot. The pupils now reacted to light, but were still somewhat dilated. . . The pulse rate was 96, and the temperature still normal. . . . This was the last time I saw the patient, but I was informed that her progress to complete recovery within the next few days was uninterrupted."

5.—The latest record of tick paralysis in Australia is by Strickland in 1915. Apparently the case (a boy) was not observed by him personally, as he states that it was described by the mother of the affected child.

The boy (aged 11) whilst in the bush, must have picked up a tick although he did not notice it at the time. The tick attached itself in his ear. Four days later he complained of feeling sick and giddy. He was put to bed but became worse. All his muscles seem to be affected. He could not walk without asssistance and his face was quite crooked on one side. The doctor on examining the patient, found a large tick in his ear. It had been there a week. The tick apparently was removed, but recovery did not take place at once as his knees were very weak and his face was no better. However, with careful feeding and medicine the child was well again in ten days after the tick was removed. The doctor said that the tick had bitten near the facial nerve and had also poisoned his blood. A footnote by Nuttall states that unfortunately the tick was neither preserved nor identified.

In view of the foregoing, the writer had for some years endeavoured to obtain ticks for experimental work; but in spite of the prevalence o

scrub ticks, and the frequency with which tick paralysis occurs in dogs around Sydney, no real start could be made until 1919. Numerous persons had been enlisted for the purpose of obtaining live ticks, but, unfortunately, in most cases where promises were fulfilled, although the intentions were good, when a tick was discovered attached to a dog or other animal, the offender would either be violently removed and the mouth parts left in the animal's skin, or some substance would be applied which would cause the tick to release its hold, but, at the same time, kill it. Such dread does the reputation of the "scub tick" inspire in the popular mind, that in no case could I persuade the owner to let a tick remain on his animal to mature. In quite a number of cases, however, ticks were brought to me, either in the nymphal or unengorged adult stage, before they had become attached to their hosts. They were all *Ixodes holocyclus*. This species of tick must either be extraordinarily delicate, or all must have been injured in removing them from their hosts, for, in all such instances, either the ticks had died before they could be put on an experimental animal (about twelve hours later), or they were so moribund that they refused to bite.

The difficulty of obtaining uninjured ticks was at last overcome by using my own dog as a collecting agent. He was encouraged to run in "bush" which was known to contain ticks. Immediately on his emergence he was carefully searched for these parasites. In this way, during 1919, about thirty adult unengorged ticks were obtained—at least half of them apparently quite uninjured. None of them had had time to attach themselves to the dog. The ticks, mostly females, but including a few males, were placed in suitable receptacles, and in from fourteen to twenty-four hours were placed on various animals, viz.: dogs, sheep, and guinea pigs. Unfortunately, however, in spite of care, all of these ticks were either dead or moribund when placed upon the experimental animals, with the exception of three adult females and one adult male. The results obtained with these were, nevertheless, quite conclusive. A large number of experiments, although undoubtedly desirable for several reasons, would not have altered the positive results already obtained.

(*To be continued.*)

To Protect Fruit Trees from White Ants.

Where a fruit tree has been attacked by white ants, scrape away all the wood that has been perforated by the insects, tracing it as far into the ground as possible, and paint the wound with a solution made up of two parts Stockholm tar to one part of kerosene. To make the solution, warm the tar until it becomes liquefied, then add the kerosene and mix. Apply with a brush, rubbing the solution well into the wood.

White ants only attack trees that have decayed or been bruised beneath the surface, and care should be taken, therefore, when cultivating or ploughing, not to tear the roots or strike the butt of the trees. There is no known way of preventing white ants attacking a tree affected as described, for the insects are always present in the soil, awaiting their opportunity.—W. J. Allen.

Some Experiences with Fruit Under Irrigation.

F. G. CHOMLEY, Manager, and J. ARTHUR, Orchardist, Yanco Experiment Farm.

THE conditions that obtain on Yanco Irrigation Farm are, perhaps, less representative of those existing on the Murrumbidgee Irrigation Area than could be desired, but many of the results that have been secured are of undoubted value to settlers, and might well be accepted as suggestive to the whole area. Indeed, it is a matter for regret that settlers do not more fully avail themselves of the experience obtained on the farm. There are, of course, those who keep in touch with the officers stationed here, and there are some who are well known and regular visitors, but there remains a large number of growers who take little heed of the large amount of practical knowledge that is being accumulated, and that is available for them on application.

In the orchard the soil (as on most of the farm) is a heavy and impervious clayey loam that requires careful handling to get satisfactory results. On the irrigation area there is a good deal of similar soil—some even stiffer, though generally settlers have to deal with soil that is of lighter texture and more easily worked. Where good methods and the best varieties are employed on these better class lands, the crops are correspondingly heavier and there is no reason why they should not be also more profitable than on the experiment farm.

The method of applying the water in this orchard is to open four or five furrows between each row, and to admit the water by means of sluice boxes, 2 inches by 2 inches inside measurement.

It is important, in general practice, that the water should reach the end of the furrow within a reasonable time, say eight or ten hours, but without so large a head as to cause scouring. After that the flow through the sluice boxes may be reduced so as to allow only sufficient water to pass through to keep the furrows full from end to end without waste. This should be continued long enough to allow the whole area to be thoroughly saturated—a period that will vary with the nature of the soil, from twenty-four hours on light soil to perhaps two or three days on heavy soils.

The peculiar nature of the soil on portions of the Yanco orchard requires a modification of the above usual practice. The surface soil, which is a red clay loam, about five inches deep, overlies a whitish cement-like soil, and this again overlies a very impervious clay band. The surface soil sets very hard, but is easily saturated by very slow watering. It is found, in practice, that the whole of the surface soil should be saturated by slow watering of the whole, rather than the ordinary way, where the soil is deeper, by running the water somewhat faster at first until the furrow is wet, and then reducing to a trickle.

In irrigating, as in other practices, slight modifications in general methods are found necessary to meet exceptional cases. The soil may not be uniform in water-absorbing capacity, or the fall may not be uniform.

The methods followed in the portion of the orchard and vineyard referred to are the result of many years' experience on this class of soil and subsoil, and must not be taken as suitable on soil of greater depth or greater permeability, or disastrous results would, perhaps, follow from excessive water on the top portion, and insufficient elsewhere.

The object in irrigation must ever be to secure even distribution, and thus even growth throughout the rows of trees and vines.

The water flows very slowly along the furrows, soaking laterally and saturating the whole area. The apple block, for instance, is 500 feet long, and for the last irrigation given, the water was turned in about 10 a.m. on 31st January; at 4 o'clock on 1st February attention was drawn by some visitors to the fact that the water had only got two-thirds of the whole distance, and actually it did not reach the lower end until about 48 hours after being turned in. The stream was then reduced at the head ditch so that just enough water was admitted to keep the furrows full for another eight hours, after which the water was turned off. A similar state of affairs arrested the attention of the same visitors when the vines were irrigated. In a block 500 feet long, the water had only reached half-way in twenty-four hours. Slow and thorough saturation is the method that gives the results. Ample experience has shown that if the water is run on fast it wets the surface, but does not soak in; if the ground is turned up a day or two later it will be found to be quite dry beneath, though apparently the surface had been a puddle.

The practice is to follow such an application, as soon as the land is dry enough, with a surface cultivation—which, it hardly needs to be said, is as important as any part of the whole business.

The use of manures and fertilisers has received attention in this orchard, and lessons have been learned that interest other irrigators. About fertilisers it is still too soon to express any definite opinion, but about the value of stable refuse and of green manuring there is not the least doubt. The orange block affords an illustration. The soil there was particularly harsh and unkind when planted years ago, but it has been built up by the application of the materials mentioned, and it is now in such free condition that during the present moist season it had only been irrigated once in the middle of January, and it yet retained its moisture and tilth a month later.

"You cannot beat stable manure; farmers should save and use every bit of it," was recently remarked here. That good crops are being obtained from orange trees planted in 1908 on this soil shows what good methods will do. The fact that one irrigation should have been sufficient for a block of citrus down to the end of January is in itself evidence of the value of manuring, for citrus are heavy surface feeders and require more watering through the summer than most crops.

Before leaving the subject of irrigation, it is worth mentioning that one of the most important irrigations of all deciduous trees is that given after harvest. Some growers are inclined to think the season is over for a block of trees when the crop has been gathered. On the contrary it is essential to saturate the soil in the autumn in order to ensure a full and active development of the fruit buds for the following season. The autumn irrigation saturates the subsoil, and it remains moist throughout the winter, being in a condition in the spring to absorb irrigation water. The development of the sugar content of a heavy crop of fruit must be a great drain on both soil and trees, and it is reasonable to suppose that a little care after the crop is off will do much toward ensuring a profitable season the following year. Autumn irrigation, as well as the early spring application, is of importance to all trees, citrus included.

It is of interest to mention, perhaps, that work is being done in this orchard with the selection of buds to maintain the true type of the Washington navel. The coarse degenerated type is being discarded, and several trees can be seen at the present time that have been cut back and budded to better types. Citrus seems to exhibit more tendency to produce coarse unprofitable types than any other fruit. The better type is not only a more thrifty tree and a heavier cropper, but it crops longer than the poorer type.

A good deal has been heard this year about the attacks of black spot and downy mildew on grapes, and in common with many growers on the Murrumbidgee areas, the farm has not escaped the attentions of these diseases. Owing to their presence, in fact, irrigation of the sultanas and currants had to be delayed till the end of January lest the humidity that follows watering should favour the development of the fungi. Advantage was taken of opportune falls of rain, however, the soil being cultivated after each shower. The diseases are fought by swabbing and spraying as recommended by the Department in Plant Diseases Leaflets Nos. 5 and 6. For black spot the vines are swabbed with a sulphuric acid solution, which holds the disease in check long enough for the buds to burst and develop a bit. It is not advisable after that to wait for favourable conditions for disease, as it will develop very rapidly at the first opportunity. Bordeaux mixture is applied when the early buds are bursting, and repeated as necessary according to the season. These applications are at the same time effective in the control of downy mildew, should the weather favour the development of that disease. The results obtained with Burgundy mixture have been just as effective as those with Bordeaux, and washing soda is always obtainable while quicklime is sometimes difficult to get.

To fight these pests on these lines requires a high power spray equipment, of course, but on the area settlers who do not spray have in cases lost the whole of their crops, while those who have sprayed consistently have saved approximately 50 per cent., and those again on soils where it is possible to get the horses on the ground soon after rain should have no difficulty in saving at least 75 per cent. of their crops.

A few references to varieties may be added. The crop of Elberta peaches has been very heavy indeed this season, and a large quantity has been dried. The Elberta block, consisting of some sixty trees in their thirteenth year, has probably carried at the rate of 10 tons of fresh fruit per acre—oh ye wonders of irrigation and of correct cultivation !

An exceedingly handsome peach is yielded by a few trees of Blackburn, a local seedling that was originally grown by a Departmental employee of that name, now deceased. The flesh is perhaps a little red when cut, and it may be that some will prefer the self colour of the Elberta as a dried product, but certainly Blackburn is a pretty and attractive fruit, and in flavour justifies its appearance. It is midseason in maturity, and in an early district would ripen a week ahead of Elberta, and thus would just miss the glut that follows the ripening of the better known variety. The peaches have not had dressings of stable manure, as have some other blocks. This year they were irrigated in November, December and January, and will yet receive the post-harvest watering mentioned above.

The show visitor may imagine that Yanco Experiment Farm's large crop of fruit is almost entirely marketed dry, but on the contrary quite half of it finds its way to Sydney as dessert fruit, and proves the truth of the Department's advice that it pays to grow only the best, and to grade out all poor and small stuff.

The prunes are well known as a dried product. The Prune d'Agen block is carrying well over 2 tons of dried fruit per acre this year, and shares honours as the best with Robe de Sergeant. They cross-pollinate one another, and are thus usefully associated in the orchard. As Robe de Sergeant ripens a little earlier than Prune d'Agen, the drying is extended over a longer period, which is an obvious advantage. In a distant part of the orchard an interesting experiment is being conducted. Some 450 feet from all other prunes are situated a few trees of Robe de Sergeant, to the midst of some of which were brought at blossoming time the blossoms of another variety of prune. It is now observed that the trees so treated have set better crops than trees to which no such blossoms were brought. Apparently, cross pollination favours "Robe"—at least it seems to act as an insurance.

Of apricots, many varieties have been tried, but none is so good as Trevatt, introduced to the area by the Fruit Expert, Mr. W. J. Allen. It originated at Mildura, is a regular cropper, is less affected by frost than other varieties growing here, and is well liked by canners.

Some forty-two varieties of apples have been tried, a number still being quite young ; but it is the older standard varieties that still command most attention, viz., Granny Smith, Cleopatra, Jonathan, King David, Yates, Commerce, and Rome Beauty. Apples have exceeded all expectations for such a hot district, but doubtless the fertility of the soil, the regular supplies of water, and the correct methods of cultivation, are the secrets. In this, as in all other fruits, too, pruning is a prime factor, but to teach it requires a book in itself.

List of Fertilisers in New South Wales.

F. B. GUTHRIE, A. A. RAMSAY, R. M. PETRIE, AND F. J. STOKES.

1921 List.

THE accompanying list of manures obtainable in New South Wales, together with their composition, as guaranteed by the vendors, is the result of the revision of the list issued in March, 1920.

The list is published in the interests of the farmers, and it is hoped that it may serve as a guide to those requiring any particular class of manure.

It must be clearly understood that the figures given are not those obtained by analysis of the sample by the Department. They represent the guarantees given by the vendors in accordance with the provisions of the Fertilisers Act.

Where possible, samples have been taken from bulk by one of the officers of the Department, and purchasers may be confident that the manures included in the list are up to the guarantee.

On account of the unsettled conditions obtaining at present, the market value of these manures may alter. An attempt has, however, been made to assign a "unit value" to the fertilising ingredients, viz., nitrogen, phosphoric acid, and potash, as in pre-war years.

A note dealing with the French potash salts appeared in the *Agricultural Gazette*, February, 1920.

A word is necessary in explanation of the column giving the "manurial value" of the manures. These figures are calculated from the composition of the manures as represented by analysis, a definite unit-value being assigned to each of the fertilising ingredients. The units on which the values given are computed are as follows:—

UNIT-VALUES of fertilising ingredients in different manures for 1920.

	Per unit. s.	d.
Nitrogen in nitrate	38	6
,, in ammonium salts	20	1
,, in blood, bones, offal, &c.—fine	30	2
Phosphoric acid in bones, offal, &c.—fine	6	0
Phosphoric acid (water soluble) in superphosphates	7	10
Potash in muriate of potash	11	9

PRICE per lb. of fertilising ingredients in different manures for 1920.

	Pence per lb.
Nitrogen in nitrate	20·6
,, in ammonium salts	10·8
,, in blood, bones, offal, &c.—fine	16·2
Phosphoric acid in bones, offal, &c.—fine	3·2
Phosphoric acid (water soluble) in superphosphates	4·2
Potash in muriate of potash	6·3

To determine the value of any manure the percentage of each ingredient is multiplied by the unit-value assigned above to that ingredient, the result being the value per ton of that substance in the manure. For example, a bone-dust contains 4 per cent. nitrogen and 20 per cent. phosphoric acid:—

4	×	30s. 2d.	=	£6 0s. 8d.	= value of the nitrogen per ton.
20	×	6s. 0d.	=	£6 0s. 0d.	= „ phosphoric acid per ton.
				£12 0s. 8d.	= value of manure per ton.

It must be clearly understood that the value thus assigned, depending solely upon the chemical composition of the manure, does not represent in all cases the actual money value of the manure, which depends upon a variety of causes other than the composition, and is affected by local conditions; neither does it represent the costs incurred by the manufacturer in the preparation, such as cost of mixing, bagging, labelling, &c. It is simply intended as a standard by which different products may be compared. At the same time, it has been attempted to make the standard indicate as nearly as possible the fair retail value of the manurial ingredients, and it will be found in the majority of cases the price asked and the value assigned are fairly close.

These figures have been checked by analyses of samples collected by an officer of the Department. It by no means follows, however, that the particular product analysed and here published will be in stock for any length of time or that the prices may not vary.

Some agents guarantee two figures—for instance, "from 16 to 18 per cent. phosphoric acid." In these cases the lower one is shown in the list, as it will certainly be the one the vendors will rely upon in cases of dispute.

Now that the Fertiliser Adulteration Act is in force, the purchaser has only himself to blame if he pays for an inferior article. Every vendor is obliged to furnish a guarantee with every delivery of fertiliser, setting forth its actual composition as determined by analysis.

If the purchaser has any reason to suspect the genuineness of the guarantee, all he has to do is to notify the vendor of his intention to take samples for analysis, in sufficient time to enable the vendor or some person appointed by him to be present. The samples must be taken before the consignment is finally in the purchaser's possession; for example, if the fertiliser is sent by rail, the sample should be taken at the railway station or siding. Three samples must be taken, one being given to the vendor or his representative, the second kept by the purchaser and submitted to an analyst, and the third forwarded to the Department of Agriculture for future reference, in case of divergence in the analyses of the other two. All three samples must be sealed up.

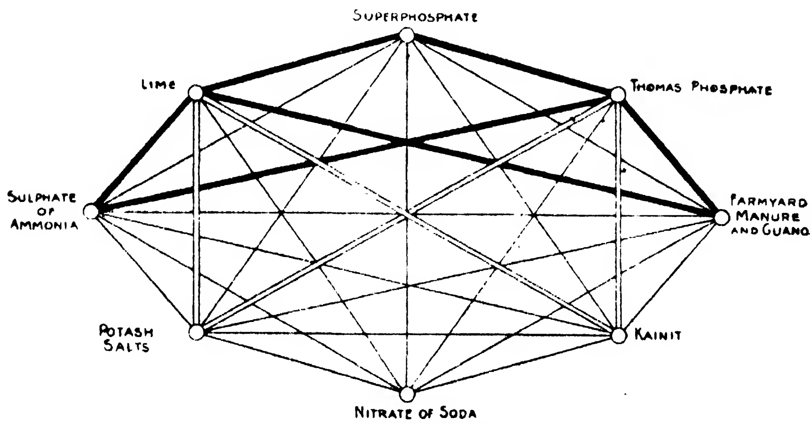
In the case of bonedust, blood and bone manures, &c., the valuation has been made on the assumption that the product is in a fine state of division, and is based on the amounts of fertilising ingredients only; but it must be borne in mind that finely-ground bonedust acts more rapidly than coarse, and that unground fragments of bone only become available as fertiliser very slowly.

In the fourth table are a number of waste products which may in many cases be economically utilised.

When purchasing a manure, always insist on a guarantee of its composition as determined by the analysis.

Never add lime to a manure containing sulphate of ammonia or blood and bone manures, as in these cases loss of nitrogen results: and when lime has been applied to the land, do not use such manures until about three weeks afterwards.

The accompanying fertiliser diagram, which represents in a graphic manner the points to be taken into consideration in the mixing of different manures, is reproduced in the hope that it will be found useful to farmers who make up their own mixtures.



Substances connected by thick line must not be mixed together.
Substances connected by double line must only be mixed immediately before use.
Substances connected by single thin line may be mixed together at any time.

TABLE I.—SIMPLE FERTILISERS.

Manure.	Where obtainable.	Guaranteed Composition. Nitrogen.	Equal to Ammonia.	Lime.	Potash.	Phosphoric Acid.	Manurial Value.
		per cent.	per cent.	per cent.	per cent.	per cent.	£ s. d.
Sulphate of ammonia	Australian Fertilisers Proprietary, Ltd. (successors to Geo. Shirley, Ltd., 7 O'Connell-street).	20·4	24·8	..	..	..	20 9 8
Nitrate of soda ..	,, ,, ..	15·6	18·9	..	..	..	30 0 0
Muriate of potash ..	,, ,, ..	..	..	..	52	..	30 11 0
,, ,, ..	,, ,, ..	..	..	..	58	..	34 1 6
Sulphate of ammonia	Australian Gaslight Co., Haymarket ..	20·4	24·8	..	..	..	20 9 8
,, ,,	Farmers' Fertilisers Corporation, 31 Hunter-st.	20·4	24·8	..	..		20 9 8
Gypsum	,, ,, ,, ..	..	..	90 Cryst. $CaSO_4$	..	.	....
Muriate of potash ..	,, ,, ,, ..	..	..	..	52	..	30 11 0
,, ,, ..	,, ,, ,, ..	..	..	..	58	..	34 1 6
Agricultural lime. (Burnt lime air slaked).	,, ,, ,, ..	..	..	..	..	..	....
Sulphate of ammonia	Paton, Burns, & Co., 75 York-st. ..	20·4	24·8	..	..	..	20 9 8
Muriate of potash ..	,, ,, ,, ..	..	..	..	52	.	30 11 0
,, ,, ..	,, ,, ,, ..	..	..	..	58	..	34 1 6
Nitrate of soda ..	,, ,, ,, ..	15·6	18·9	..	..	..	30 0 0

II.—Bone and Blood Manures.

Manure.	Where obtainable.	Guaranteed Composition. Nitrogen.	Equal to Ammonia.	Phosphoric Acid.	Equal to Tricalcic Phosphate.	Manurial Value.
		per cent.	per cent.	per cent.	per cent.	£ s. d.
B. and B. manure	Kitchen and Sons, Ltd., 365 Kent-st.	5·0	6·07	17·0	37·11	12 12 10
Extra B. and B. manure	" " "	5·0	6·07	13·0	28·38	11 8 10
Bone and blood	R. S. Lamb & Co., 32 Jamieson-st.	5·0	6·07	11·9	25·98	11 2 3
No. 2—Pure steamed bonedust	Wooster Fertilisers, Ltd., O'Riordan-st., Alexandria	3·9	4·75	24·50	53·50	13 4 8
No. 3—Blood and bonedust	" " "	5·76	7·00	13·74	30·00	12 16 2
No. 5—Green bone meal	" " "	4·01	4·86	24·41	53·30	13 7 5
Excelsior bonedust	M. Gearin and Sons, Old Botany road, Mascot	3·29	4·00	21·98	48·00	11 11 2
Bonedust	M. O'Riordan and Sons, O'Riordan-st., Alexandria	3·7	4·5	21·98	48·00	12 3 6
Pure fertiliser	N.S.W. State Abattoirs, Homebush Bay	6·68	8·11	10·87	23·73	15 6 9
Bone and offal	Newcastle District Abattoir Board, 27 Hunter-st., Newcastle.	5·02	6·10	19·89	43·42	13 10 9
Dried blood	" " " "	13·29	16·14	......	......	20 0 11
Sandown blood and bone fertiliser	J. Cooke & Co., Propy., Ltd., Sandown Works, Parramatta.	6·85	8·32	11·40	25·50	13 15 0
Blood	B. Richards and Sons, Ltd., Riverstone	11·00	13·36	......	......	16 11 10
Blood and bone	" " "	6·0	7·29	13·00	28·38	12 19 0
Bonedust, B.D. 1	Paton, Burns, & Co., 75 York-st.	3·7	4·49	22·12	49·29	12 4 4
" B.D. 2	" " "	3·7	4·49	22·12	49·29	12 4 4
" B.D. 3	" " "	3·3	4·01	20·7	45·19	11 3 9
Bone and blood manure, B.B. 1	" " "	8·0	9·71	8·0	17·46	14 9 4
" " " B.B. 2	" " "	5·0	6·07	17·0	37·11	12 12 10
Bone phosphate	" " "	......	.....	29·77	64·99	......
Dried blood	" " "	11·0	13·36	......	......	16 11 10

III.—Superphosphates, Mixed Fertilisers, and Imported Fertilisers.

Manure.	Where obtainable.	Guaranteed Composition. Nitrogen.	Water-soluble Phosphoric Acid.	Total Phosphoric Acid.	Potash.	Manurial Value.
		per cent.	per cent.	per cent.	per cent.	£ s. d.
Superphosphate	Australian Fertilisers Protrietary Ltd. (successors to Geo. Shirley, Ltd., 7 O'Connell-st.)	......	17	......	.....	6 13 2
Basic Superphosphate	,, ,, ...	......	......	20	......	.....
No. 2	,, ,, ...	2	10	......	1	6 10 3
No. 4	,, ,, ...	4	8	......	2	8 6 6
No. 5	,, ,, ...	3	10	......	7	11 0 10
No. 6	,, ,, ...	3	10	......	4	9 5 7
No. 8	,, ,, ...	4	11	......	......	8 6 6
No. 10...	,, ,, ...	2	13	......	......	7 2 0
No. 11	,, ,, ...	......	12	......	4	7 1 0
No. 1 Superphosphate	Farmers' Fertilisers Corp., Ltd., 31 Hunter-st. ...	......	17	......	... ..	6 13 2
No. 7 Complete fertiliser	Wooster Fertilisers, Ltd., O'Riordan-street, Alexandria	5·01	5·00	14·56	2	11 12 9
No. 0 Phosphatic fertiliser	,, ,, ,,	3·30	5·00	20·61	......	11 12 5
Sulphide Superphosphate	Gibbs, Bright & Co., 37 Pitt-street	......	17·0	......	......	6 13 2
Nitro ,, ...	,, ,, ...	1·6	15·0	......	......	7 15 8
No. 1 Bone and ,, ...	,, ,, ...	1·5	8·5	19·0	......	8 14 10
No. 2 ,, ,, ...	,, ,, ...	0·8	13·0	19·0	... ..	8 2 0
Potato manure	,, ,, ...	1·25	14·5	16·0	3·5	8 19 10
Orchard ,, ...	,, ,, ...	2·3	13·0	14·5	4·5	10 0 11
Maize and fodder crop manure ...	,, ,, ...	3·0	11·0	14·0	1·0	8 12 5
Root crop ... ... ,, ...	,, ,, ...	3·25	7·5	11·0	3·0	8 11 11
Leguminous ... ... ,, ...	,, ,, ...	......	15·5	18·0	2·4	7 9 8
Special orchard manure	,, ,, ...	2·3	12·0	12·8	7·25	11 5 5
Superphosphate	Paton, Burns, & Co., 75 York-st.	......	17·0	.....	......	6 13 2

IV.—Waste-Products, Ashes, &c., not on the Market.

Manure.	Original Source.	Water.	Volatile and Combustible.	Nitrogen.	Insoluble.	Lime.	Phosphoric Acid.	Potash.
		per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Deposit from wool-scouring tanks 1	Liverpool Wool-scouring Works			·64				·72
Deposit from wool-scouring tanks 2	,, ,, ,,			1·02			·16	·39
Deposit from wool-scouring tanks 3	,, ,, ,,			1·37			·14	·2
Deposit from breakers	,, ,, ,,	34·47		1·81	50·68	·85	·88	1·80
Sediment from wool-scouring works	Yass	19·57		·59	8·24	·97		·20
Scutch	Australian Glue-Gelatin Works, Alexandria.	56·98		2·95		4·56	None.	None
,, from limed pelts	Hugh Wright, Auburn	5·32	72·42	1·80	3·61	9·36	·89	·20
Decomposed hair and lime	Fellmongery	9·70	57·08	6·86	1·22	26·27		
Tan-yard refuse	Tanneries, St. Mary's	6·43	33·83	2·24	21·43	26·96	·67	
Tan refuse		7·10	50·90	2·62	16·03	18·58	·56	·18
Fleshings from tannery		·91	75·37	44·43	5·98		1·14	·04
Salt (sweepings from tannery)		3·04		·70	·38			
Wool-waste				8·15				
,,		34·33	28·20	1·97	26·03	2·75	·37	·32
Peat	H. Tager, Moss Vale	72·93	16·68	·25	10·39 (ash).			
,,	S. Cook, Pyrmont	49·51	34·63	·75			·06	·01
Burnt peat					84·45		·25	·33
Filter-press muck	Cane-mills, Broadwater	16·39	26·07	·22	34·86	13·20	5·98	·44
Megass	Clarence River cane	22·86	67·32	·63	8·61	·30	01	·05
Megass ash	,,				87·69	3·07	·16	·51
,,	Richmond River cane					1·11	·21	4·79
Bloodwood ash						8·47	·27	5·25
Ironbark ash							·82	1·53
Blackbutt ash						7·27	·04	2·02
Red-gum ash							·38	4·17
Spotted-gum ash							·10	·70
Boxwood ash							·67	1·65
Grass-tree ash		·86	1·78		33·48	24·94	3·07	5·30
Vine-cuttings ash		·49			60·64	11·34	1·85	3·76
Red-apple ash					54·52	13·96	·47	6·00
She-oak ash					8·57	42·35	8·85	2·19
Hardwood ash		·50	1·35		62·38	13·50	1·76	3·09
Ash of wild melon	Stock Branch					5·12	4·85	27·08
Wood ashes		·30			21·43	41·37	·35	2·80
,,	Wentworth Irrigation Area				11·12	50·78	·58	3·21
Ash of kerosene shale	Hartley Vale	1·49	27·93	·70	67·59		·28	·14
Eucalyptus leaves ash								10·54
,, ,,								20·50
Camphor laurel ash								2·55
Coachwood and sassafras wood ash						16·16	3·60	13·53
Gidgea wood ash						40·3	·36	·25
Bracken fern ash					56·17	9·64	5·09	4·98
Broom millet ash		2·59			57·23	6·11	4·67	15·53

IV.—Waste-Products, Ashes, &c., not on the Market—*continued*.

Manure.	Original Source.	Water.	Volatile and Combustible.	Nitrogen.	Insoluble.	Lime.	Phosphoric Acid.	Potash.
		per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Coals (ash)						·64	·29	·16
Clinker from locomotive boiler								·25
Residue from furnace	R. E. Bragg, Marrickville	1·55	35·63	·54	52·40	·64	·43	·09
Sea-weed ash						9·27	·49	·59
"						6·29	1·27	17·55
"		·43			56·28	9·39	·47	2·26
"	Manly				43·06	6·52	·91	13·98
"	"				·07	·53	·19	34·30
"	Mr. Harvey, Department	3·25	19·46		61·63	4·22	·33	·22
"						4·63	1·00	31·41
Sea-weed, fresh state		80·00		·16		·41	·09	1·18
Sea-weed		41·03	42·49	·14			·21	·60
Sea-weed, dried		18·58	65·97	1·64	15·44 (ash).	3·44	·14	·14
Sea-weed, air-dried		3·60			39·89		·42	1·02
Air-slacked lime		16·58			1·88	75·44		
Residue from calcium carbide		41·36			1·08	36·19		
Limestone rock	Queanbeyan	1·10			4·70	48·20	1·22	
Agricultural lime	Portland Cement Co.	18·43			23·80	Hydrate 13·80 Carbonate 43·97		
Gypsum	Marulan	(Crystallised $CaSO_4$ = 92·64)			4·47			
Cave deposit, shells, &c.	Cowan, Hawkesbury River	2·11		·82		35·40	1·59	·88
" "	Macleay River	23·06	16·01	2·43	26·77	13·88	7·40	
Deposit (coral, shell, &c.)	Pacific Islands	2·13	13·53	·72		44·00	3·53	·39
Shells	Pambula River					44·59	·10	
Flue deposit	Maitland				83·75	2·56	·32	·31
"	Liverpool				91·17	·42	1·29	·17
" from sanitary furnace					63·53	6·64	1·82	1·61
"		6·30	2·45		84·89	·32	·35	·38
Night-soil mixed with lime		44·33		·74	18·60	7·62	·78	
Night-soil	Wagga Wagga	6·70		·03	82·19	·44	·28	·69
"	"	9·14		·28	78·92	1·18	·18	·54
"	"			·50			·6[illegible]	·62
Night-soil preparation, No. 1		8·22		3·73	50·22	13·32	9·65	·91
" " No. 2		7·20		1·83	29·02	8·05	4·10	·15
" " No. 3		25·95		1·64	60·17	1·39	1·61	·70
" " "Pinhoe" manure		·92	9·54	·21	57·58	14·71	1·26	·56
" "	F. Artlett, Parramatta	7·33	30·06	2·10	46·38	2·09	1·92	·61
" "	" "	10·11	42·59	4·97	·94	30·12	·39	
" "	Mr. Halstead, O'Brien's patent	1·54	12·36	·54	77·95		·63	
" "		29·52	56·15	2·55	14·33 (ash).			

IV.—WASTE-PRODUCTS, ASHES, &c., NOT ON THE MARKET—*continued.*

Manure.	Original Source.	Water.	Volatile and Combustible.	Nitrogen.	Insoluble.	Lime.	Phosphoric Acid.	Potash.
		per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Street sweepings	Sydney Municipal Council	61·63	19·57	·35	15·45		·42	·28
Farmyard manure		67·96	22·09	·40	8·16	·16	·20	·30
Stable manure	Bathurst	39·28		·41			·27	·67
Fowl manure		3·95	16·48	1·47	70·16	2·10	1·94	
"		1·54	15·23	·86	79·96	·64	·59	·33
Fowlyard manure		4·8	14·26	·91		3·12	84	
Sheep manure	Bathurst	7·73		1·06			·69	1·17
"	Liverpool Wool-scouring Works	9·71	50·91	1·79	32·26	2·30	·91	·92
Sheep dag				3·04				
Refuse manure	Abattoirs	12·00	74·51	4·14	6·56		1·80	
Flying-fox manure		1·09	35·34	3·34	50·29	1·02	·36	1·15
Fish fertiliser		14·47	64·36	10·37	4·52			
Shark fertiliser		9·02	68·04	10·59	3·86		7·27	
Fish manure		10·88	59·26	6·10	5·39	9·82	8·28	
Rabbit hair, long	Anderson, Oxford-street	8·73	88·64	14·03	3·63 (ash).			
" short	" "	9·72	87·76	14·00	2·82 (ash).			
Bat guano		14·11	17·69	1·55	28·77	13·72	11·42	
"		10·86	19·65	2·24	51·95	1·75	3·55	·15
"		13·70	34·35	4·76	3·90	22·28	13·04	trace.
Bat deposit	Cave Flat, Cooradigbee	5·43	12·98	·50	57·64	5·60	12·12	
Guano deposit	Tamworth	8·75	38·40	6·17	12·85		9·24	
"	"	3·42	20·97	3·10	31·89		7·87	
"	"	14·55	29·91	3·66	15·81		12·98	
"	"	9·35	44·32	6·73	7·33		13·17	
Ground guano		4·57	11·44	·21		34·90	28·20	·22
Deposit from cave	L. R. Mercy, Ashford	23·75	35·57	3·63	1·65	16·32	11·28	·60
Bone breccia	Queanbeyan	5·71		·59	9·48	42·80	3·11	
Muck from waterworks reservoir	Maitland	4·84	17·55	·74	63·42	4·56	·31	·60
Muck raked from waterhole		63·66	29·86	·81	3·80	·96	·10	·06
Sawdust		33·52	62·35	·82			1·70	·05
Decayed wood, bark and leaves, bloodwood		57·80		·74	40·68	1·30		
Decayed wood, bark and leaves, pepper-tree		79·92		·8	17·77	1·50		
Coconut oil cake		8·24		3·29			1·20	1·49
Castor cake		18·81	74·08	4·30			1·83	·86
Pea cake	Java	16·02		7·24			1·46	1·17
Bean cake	North China	14·52	80·32	6·77			1·33	1·99
Rice husks		42·74	42·15	1·07	13·77	·02	·03	·04
Field pea, whole plant		88·58	9·97	·55		·15	·12	·49
Tares, whole plant		83·97	14·96	·73			·11	·21
Marsh mallow, whole plant		79·00	17·86	·85			·14	·69
Horse bean, leaves and stalks		82·87	15·90	·90		·05	·11	·54
Refuse from wheat cleaner	State Wheat Office, Pyrmont	9·78	81·52	3·29	8·70	·4	1·18	·66
Whale bones		8·53	28·04	3·64			28·13	

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture now publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of wheat, oats, maize, sorghum, Sudan grass, potatoes, and other crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

This list is compiled after inspection of the seed and report by a field officer of the Department (preferably during the growth of the crop), and farmers who have pure high-class seed of good quality of any variety of farm crop are therefore invited to communicate with the Under Secretary and Director, Department of Agriculture, Sydney.

The Department does not undertake to buy any of the seed, but recommends the grower by publishing his name in this list. The following list indicates where pure seed, recommended by the Department, is at present obtainable:—

Wheat:—

Billy Hughes	Manager, Experiment Farm, Condobolin.
Bomen	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	H. M. Hall and Sons, Studbrook, Cunningar.
Canberra...	S. M. Haig, Lisburn, Wombat.
	E. J. Allen, Gregra.
	R. J. O. Berryman, Anicmoore, Botfield's Siding.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
Clarendon	Manager, Experiment Farm, Condobolin.
Cleveland	W. Burns, Goongoowarrie, Carcoar.
College Purple	Manager, Experiment Farm, Temora.
Comeback	Manager, Experiment Farm, Temora.
Currawa	Manager, Experiment Farm, Temora.
Federation	Manager, Experiment Farm, Temora.
	H. M. Hall and Sons, Studbrook, Cunningar.
Firbank	Manager, Experiment Farm, Nyngan.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
Florence	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Condobolin.
Genoa	Manager, Experiment Farm, Glen Innes.
Gresley 83	Manager, Experiment Farm, Temora.
Hard Federation	E. J. Allen, Gregra.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Condobolin.
Improved Steinwedel	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
King's Red	Manager, Experiment Farm, Temora.
King's White	Manager, Experiment Farm, Temora.
Marshall's No. 3	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Marquis	Manager, Experiment Farm, Glen Innes.
Major	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Temora.
Penny	E. J. Allen, Gregra.
	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Temora.
Red Wing	Manager, Experiment Farm, Condobolin.
Turvey	W. W. Watson, "Woodbine," Tichborne.
Warren	Manager, Experiment Farm, Trangie.

PURE SEED—*continued.*

Wheat—continued.	
Warden	W. W. Watson, "Woodbine," Tichborne.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Manager, Experiment Farm, Temora.
Yandilla King	W. L. Forsyth, Braeside, Wallendbeen.
	E. J. Allen, Gregra.
	S. M. Haig, Lisburn, Wombat.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Zealand	Manager, Experiment Farm, Temora.
Oats :—	
Algerian	Manager, Experiment Farm, Glen Innes.
Guyra	S. M. Haig, Lisburn, Wombat.
White Tartarian	Manager, Experiment Farm, Glen Innes.
Clovers :—	
Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
Bokhara Clover or Sweet Clover	A. Sommerlad, Hillcrest, Tenterfield.
Canary Seed :—	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Condobolin.

It is especially desired at the present time to locate reliable sources of seed of Thew, Huguenot, Firbank, and Florence wheats, Sunrise, Ruakura, and Guyra oats, and Cape and Skinless barleys, the demand for seed of which for coastal green fodder far exceeds the visible supply.

In addition to those tabulated a number of crops were inspected and passed for purity, but as the growers failed to forward samples their seed has not been listed.

VINEYARD NOTES FOR APRIL.

THIS month will see the termination of vintaging. In the early districts vintage has already finished, but in the later areas the late varieties such as Doradillo remain to be picked. The practice of turning stock into the vineyard as soon as the last grapes have been carted out is not one to be recommended. Not only are stock liable to injure the wood by pulling off and breaking shoots that may be required for selection of pruning wood, but the fact that the leaves are removed before their functions have ceased work is entirely detrimental to the vine.

As soon as the grapes ripen, the natural process of ripening the wood begins and continues until the leaves fall in the autumn. The ripening consists in the hardening of the woody fibres and the storing up in the pith of a supply of plant food for the following year.—H. L. MANUEL.

NEW LIST OF THE DEPARTMENT'S PUBLICATIONS.

A NEW list of the publications issued by the Department is now obtainable free on application to the Under-Secretary and Director, Department of Agriculture, Sydney.

In reference to the availability of these publications one still hears the remark that "many farmers don't know." The Department is desirous that every farmer, however far away from rail or township he may be situated, should be aware that only the expenditure of twopence for the postage on a letter of application is necessary to put him in touch with the latest recommendations concerning his particular branch of agriculture. The great bulk of the publications are free, and the list covers more than seven hundred different aspects of farming.

Poultry Notes.

April.

JAMES HADLINGTON, Poultry Expert.

Some hints on the selection of breeding stock appeared in last month's notes. This is not too early to get the breeding stock into the pens, for if the work is left until next month it often results in a late start with the hatching season. The 1st May is the date by which all breeding hens and pullets should, if possible, be got settled in their permanent quarters. The males need not be put in the pens until a couple of weeks later, although no harm will result from making the matings complete, and no good will accrue from keeping the males separated from the hens when, if cockerels, they are 10 months old, or in the case of the older birds after they have finished their moult. The notion that the male birds are best kept by themselves except during the time eggs are required for hatching is unsound, and the practice of entirely segregating the males over the other part of the year leads to many birds becoming sterile, and particularly so with heavy breeds.

Treatment of Laying Stock.

The advice in regard to settling the breeders in their permanent quarters applies equally to laying stock. Any changes of position or conditions made on the eve of the beginning of winter is almost sure to cause loss in egg-production. As was pointed out in last month's notes, autumn and winter egg-production is largely dependent upon early hatched stock, and upon the class of development secured. Nevertheless, the skill with which birds are managed over the coming months will be a big factor in keeping them in laying condition.

Housing and Treatment of Pullets.

Observations over the last few months make it painfully clear that the average poultry-farmer has still much to learn about the handling of forward young stock during the summer months, when it is reaching the laying stage. One of the most common errors seen is the practice of pushing forward immature pullets into the adult houses in large numbers. This, of course, refers to housing in big flocks of 150 and over. Such housing accommodation is recommended for mature stock, but it is very risky for immature birds; and, as a matter of fact, no matter how large the house, the practice amounts to the same thing and is fraught with the same consequences as overcrowding, which is particularly fatal to all growing stock.

The moist weather conditions that have prevailed during the greater part of this summer have been particularly trying to pullets just starting to lay; but the practice referred to has accentuated the trouble to such an extent

that, even where no disease has actually made its appearance, the pullets have broken into a moult in many cases fully two months earlier than might have eventuated had they been housed in smaller numbers until more mature.

The safest plan is to house pullets, or for that matter, all growing stock, in not more than fifties until the hot weather is over. If the attendant wishes to ascertain the reason for the resultant troubles due to housing pullets in big flocks, let him visit the poultry houses on some of the almost tropical nights, such as have been experienced this past summer, and test the atmosphere over the pullets that are packed as closely together as is usual, no matter how large the house. He should then be satisfied on this point.

Another matter of importance in regard to preserving pullets from the moult to which they are so liable, is that any change in the food ration to which they have been accustomed is pretty sure to lead to a cessation in laying, followed by a break into a partial or "pullet moult." It is therefore important that once they have started to lay no change be made in diet. The most skilful feeding is necessary with a view to the least possible disturbance in health. It should be remembered that changes and conditions that might cause no appreciable falling off in laying during the spring months might be so fatal in the autumn and winter as to reduce the egg-production almost to vanishing point.

Duck-farming.

Quite a number of inquiries have been made relating to ducks. Time was when duck-farming was quite as profitable as poultry, if not more so. Those were the times of cheap pollard and bran, and when meat offal was plentiful and easily obtained, and, too, when the tallow skimmed from the boiling down of such offal and restaurant refuse would cover the cost of the material, including collection.

There is still a limited amount of this kind of duck-farming carried on; but the opportunities of securing cheap food (and this is the basis of profitable duck-farming) are continually being narrowed by the withdrawal of the materials mentioned, some of which are now being treated by more scientific and up-to-date methods. Hence duck-farming is no longer the profitable occupation it once was.

To make duck-farming pay, the farmer must possess some advantage in the matter of a cheap food supply. Many imagine that green food can be grown for this purpose. Unfortunately green food, while beneficial and necessary, will not take the place of more substantial food. It might be argued that duck-raising must be profitable, considering the prices they now make, particularly at Christmas time; but unfortunately we cannot ensure any large supply of prime ducks for that festive period. It should, of course, be understood that ducklings for table purposes cannot be kept for the same length of time as cockerels, and still remain prime.

In the case of Muscovies the whole period over which the drakes are prime is thirteen to sixteen weeks, so that the time for marketing in prime condition is very short; nor does it pay to keep them longer. Ducks must

be marketed when they are ready and not at the pleasure of the farmer. If calculations could be based upon the ducks actually raised without regard to the cost of feeding the adult breeding stock which it is necessary to keep to ensure sufficient eggs for setting, or if ducks were better layers, the case would be altogether different.

However, there are certain situations and circumstances in which ducks will still pay, and a few hints on duck-raising will doubtless be of service.

Black Orpington Hen.

This bird is typical of the breed when it was at the zenith of its fame fifteen to twenty years ago. It was a good class of bird for utility purposes, yet sufficiently attractive to the fancier. (Bred at Hawkesbury Agricultural College, 1916.)

There is no particular difficulty or art in rearing ducks. As a matter of fact, they are often reared with but little care or attention. The case is altogether different, however, where large numbers are reared, as in the case of commercial duck-farming.

Breeds and Varieties of Ducks.

For utility purposes we have a choice of the Muscovy and the popular English ducks, such as the Aylesbury and Pekin, followed by the Rouen and minor varieties. These are all classed as table ducks. We have then the popular Indian Runner, which has the reputation of being such a great layer, but which is an indifferent table duck, being too small.

The Pekin, Aylesbury, and Rouen, and sub-varieties, such as Buff and Blue, can be marketed at two different ages, viz:—nine to ten weeks old, when they have completed their first feather, or at fourteen to sixteen weeks, after their first moult.

Muscovies are a class by themselves, and are as a matter of fact geese rather than ducks. For table purposes, they are at their best (as already stated) at from thirteen to sixteen weeks old.

The Pekin and other varieties take twenty-eight days to incubate, and can be successfully hatched in incubators and reared in brooders, but do not require artificial warmth for more than about two weeks. The Muscovy eggs do not hatch well in incubators or rear well in brooders, and the best method of both hatching and rearing is with the mother duck.

Rearing.

The one fatal circumstance in rearing is allowing the ducklings to get wet, either by rain or by a dewy condition of the grass, and particularly is this important towards evening before they go up to camp. The duck-farmer requires plenty of shed room for rearing if his attempt is in large numbers.

Feeding.

Simple fare is all that is necessary. Pollard and bran, mixed with liver or other meat soup, or with milk, and made to such a consistency that it will hang together well without being sloppy, is best for the first few weeks, when some grain might be allowed in the evening feed. The best practice is to incorporate the grain in the mash after soaking or steaming. Meat offal, rabbits, or the like, might from this stage on form a considerable portion of their feed. Grit and wood ashes should be always before them, and on no account should ducklings be stinted of water, or trouble in the form of staggers will follow. They should have plenty of water to drink, but it is a mistake to allow them water to swim in. That ducklings should not get wet while in the down is a duck-farmer's axiom. Stock ducks should have access to water for a couple or three hours per day, preferably in the afternoon. But this applies more to other breeds than to Muscovies, which can do very well without access to water to swim in.

Diseases.

The most prevalent disease among ducklings is what is known as "white eye." This disease is analogous to roup in fowls, and is very fatal. There is no known cure for it, and when it breaks out the best remedy is a drastic one. Kill and burn all infected birds; they will not live in any case. Then give the ground a rest and a surface dressing of lime; no ducks should be run on it for at least a year. The practice of putting permanganate of potash in the water is quite useless to effect a cure or even to prevent contagion in this disease. The contributing causes favouring an outbreak of this disease are crowding together and insanitary conditions.

Orchard Notes.

April.

W. J. ALLEN and W. LE GAY BRERETON.

Harvesting.

April is still a fairly busy month for the fruitgrower in the late districts. The dispatching of regular consignments will be going on, also the picking of the late varieties.

Where Granny Smith apples will hang without too much waste from windfalls, they will improve much in quality if allowed to do so and picked as late as possible for storage. Late-picked Granny Smiths come out of store a far superior dessert fruit to those early-picked.

Prices for apples have not been too attractive, and we may still expect large quantities from other States. It therefore seems advisable to store late long-keeping varieties, and only to send them forward gradually as the market clears.

The pears Packham's Triumph, Vicar of Winkfield, Winter Nelis, Broom Park (Knight's Monarch) and L'Inconnue could also be cool-stored, if present prices do not warrant marketing them at once.

Great care should be exercised with fruit intended for storage—bruised fruit or specimens with the skin broken cannot be expected to keep. Wrapping fruit intended for storage checks evaporation, and it therefore does not go "sleepy" as quickly as when naked. Wrapping also lessens the liability to stalk punctures. All fruit should be cooled off as much as possible before being stacked in either cold or ordinary storage.

Trials have been made at the orchards at Bathurst and Glen Innes Experiment Farms with a 5-tier 3–3 pack for apples in the Canadian case (20 inches long x 11⅛ inches wide x 10 inches deep) instead of the 6-tier 3–3 given in *Farmers' Bulletin* No. 130, "The Packing of Fruit." The 5-tier 3–3 comes up with the apples placed on "cheek" or "edge," which is superior to packing on the "flat."

The following chart gives the counts for the 3–3 x 5 tiers for the above case, when made up with 11⅛ inches width x 10 inches depth.

7—6 = 195	8—8 = 240
7—7 = 210	9—8 = 255
8—7 = 225	

The counts of the other packs for the Canadian case, viz., 2–2 x 4 tiers and 3–2 x 5 tiers remain as given in the bulletin named.

Planting.

In the warmer coastal districts it is not too late to plant out citrus trees this month. In districts where winter frosts occur, provision should be made for covering them for the first two or three years after planting. Bushes or corn stalks are sufficient. It is preferable not to have the covering too thick,

as it is found that densely covered trees suffer almost as severely as uncovered trees; it is advisable not to go to either extreme—too much or too little.

If not already carried out, the land intended for planting with deciduous trees this season should be prepared by ploughing and subsoiling. By doing so, the soil is not only sweetened, but a greater portion of any rain that falls will be retained and the trees can be put out early in the planting season.

Where refills are to be planted amongst old-established trees, a large hole should be dug where the new tree is to go and filled in with new soil.

Pests.

The scale insects of citrus trees have, by this time of the year, developed their protective covering and are more difficult to kill with sprays, such as resin-soda wash, than earlier, but there is still time to get an excellent kill with fumigation. Leaflets on this work can be obtained from the Department of Agriculture. The destruction of any infected fruit or fruit-eating grubs should be continued.

Cultivation.

Where cover crops for green manuring have been sown, no further cultivation will be carried out till such crops are ploughed under in the winter.

Where no cover crop has been sown, the autumn ploughing, if not through, can be proceeded with. Such ploughing is especially beneficial in districts of light rainfall, and if irrigation is not available.

Manuring, Soiling and Liming.

As harvesting operations slacken, every opportunity should be grasped to cart all available farmyard manure to the orchard. This material is specially valuable in keeping up the humus content of the soil. The autumn is also a good time for carrying out re-soiling and liming. Needless to say, none of such carting should be done while the ground is wet and boggy.

Fruit Trees that have been Blown Over.

"During the heavy rain and gales of December, some of my trees were blown down," wrote a Bankstown orchardist recently. "I put them in position by tying them to stout stakes with rope and bagging around the trunks, and also put earth about half-way up the trunk of each. Should the earth and stakes be taken away when the trees are re-established, or can they be left as they are in case of further gales?"

The correspondent was informed that it would be safer to leave the stakes in for at least another full growing season, thus giving the roots a chance to get a thorough fresh hold of the soil; in all probability the trees would then send out some new big or "anchor" roots. The stakes should be so placed as to avoid any likelihood of their chafing the main stem or limbs, and the trees and bagging should be examined periodically to see that they were not cutting into the bark or harbouring any harmful insects. It was because of the necessity for these precautions that the use of stakes was usually avoided where possible. The banked-up soil should eventually be removed, so that the union of stock and scion should be at least 2 or 3 inches above ground level.—W. J. Allen.

Agricultural Bureau of New South Wales.

A SUGGESTED SUBJECT FOR DISCUSSION.

Mr. F. G. Chomley, Manager of Yanco Experiment Farm, in a memorandum on farm homes in this State, remarks that the subject might be taken up by the branches of the Agricultural Bureau with profit. He suggests that personal and home comfort, especially for the women of the household, is not considered in the measure in which it might be, and, indeed, should be, if rural life is to be attractive.

"The general run of wheat farmers," he writes, "are more or less in districts of limited rainfall, severe summer heat, dust, flies, and mosquitoes; but the house itself is too often a collection of galvanised iron, without verandahs, equipped with an undersized tank for drinking-water, and a gardenless track to the stables, which, themselves, are usually of the most meagre description and afford no shelter for the machinery. To this life the men become inured, but the women either drop their bundles or become depressed by the hopelessness and unattractiveness of their surroundings.

"The beautifying of the home is not impossible, except in the absolute desert. Simple architecture does not entail greater expense in construction than unbalanced and awkward designs. Pergolas, shade trees, or bough-shade houses are not for the idle rich only. I have in mind two farms—one having a really good orchard and a good old bush dwelling, wide verandah, fly-screen doors; the other, the most desolate place imaginable, with one pear tree, twelve years old, in front. I know of another dry farmer who has each year as good fruit, vegetables, and flowers, as any produced under irrigation, yet he has only water available that has to be carted from a tank. It is the only farm within miles where any attempt has been made to make the home look like a home. I would certainly suggest that more attention be paid to the domestic side of farming, the improvement of the dwellings, the introduction of domestic conveniences, the planting of shade trees and flowering shrubs, and the provision of water. Lately, I was through a lot of new country in the southern Riverina and saw homes, some new, some old, but with the exception of old station homesteads, I saw nothing that would not give one the blues to think of living in—and some of them close to water, too. This is work for the Agricultural Bureau, and is just as important as more bushels per acre."

REPORTS AND NOTICES FROM BRANCHES.

NOTE.—While gladly publishing in these columns the views of members of the various Branches of the Agricultural Bureau, the Department does not necessarily endorse the opinions expressed.

Adamstown.

The monthly meeting was held on 24th February, when a lecturette was given by Mr. E. B. McPherson on the pruning, cultivation, and manuring of fruit trees and grape vines. Mr. C. Crowther also furnished a useful essay on the peach tip moth. Both gentlemen answered questions to the advantage of the hearers. Steps are being taken by this branch to form a ladies' branch of the Bureau, at which subjects like bottling of fruits,

cookery, needlework, poultry-raising, horticulture, &c., can be discussed. The office-bearers are:—Chairwoman, Mrs. Lewis; Treasurer, Mrs. Boekenstein; Hon. Secretary, Mrs. Brock. The example is worth the attention and emulation of other branches, and the movement is sure to be watched with interest.

Auburn.

This branch is holding monthly shows for horticulturists and others, and a show on a somewhat larger scale is to be held on 23rd April.

Bimbaya.

This branch some time ago took steps to organise a non-competitive exhibit for the Candelo show, and the idea was taken up with such enthusiasm by the Candelo Society that a money prize of £10 was offered, and three portions of the district staged exhibits, viz., Bimbaya, Kameruka, and South Wolumla. All three exhibits were excellent and formed a remarkable feature of the show, nothing like them having been seen before in the district. "They were brimful of interest and instruction, and attracted universal admiration," read one appreciative account. Pride of place was awarded the Bimbaya branch, which eclipsed its competitors in scope and arrangement, though in quality the competition was very keen indeed in several lines.

Blacktown.

At the February meeting it was resolved to co-operate with the Kellyville branch in securing public markets for fruit, vegetables, fodder, live-stock, &c., at Parramatta.

Dapto.

At a meeting on 10th February Mr. G. H. Walker read a paper on manuring, from which the following paragraphs are taken:—

Manuring.

In reading general farming literature, our attention is forcibly drawn to the place that manuring has in cultural economy; in fact, there is no farming without it. The manure heap or pit is an essential to be first considered. If an English farmer sells his hay crop he estimates how much manure he must purchase to replace what he has sold in manurial elements with the sale of the hay. The dairyman who sells his milk has to reckon that every cow yielding 700 gallons of milk annually diverts from the food eaten to the milk 42 lb. nitrogen, 16 lb. phosphoric acid, 14 lb. potash. Multiply this by the number of cows giving the approximate 700 gallons and you will gain an idea of what you must replace to maintain the fertility of your land.

Conditions are very different here from what obtains in the colder countries, where animals are stabled and bedded for upwards of six months of the year. Manure is thus made, storage is provided, and in due time a valuable product is carted to the land.

England, Denmark, and other continental countries need to manure largely to get adequate returns—up to as much as 14 tons of farmyard manure to the acre, supplemented with chemical mixtures. America, a comparatively new country which has its hundreds of worn-out and deserted farms, is seriously turning its attention to restoring and maintaining fertility, nearly every farm having its manure-spreader.

These countries all stable their animals; but here, where our animals are never under cover except at milking time, the question arises, where are we to obtain manure? Pig and cattle excreta are spoken of as cold, and horse manure as hot, and as we do not bed the animals a substitute must be found; the compost heap is the only way. As a general method of procedure the following will be found satisfactory:—Make a heap of alternate layers of earth, refuse, and lime. Cover the whole with a layer of earth. When a sufficient

quantity of refuse is again collected, place it on top of the heap and cover with a layer of lime and lastly of earth, until the heap is 3 or 4 feet high. The heap should be kept moist, and for this purpose all refuse water from the house should be added; the heap may be conveniently watered by making a hole into the interior and pouring the liquid in. The outer covering of earth has the object of absorbing any ammonia which is evolved in the process of fermentation and by the action of the lime. Urine is especially valuable as a fertilising agent, containing as it does the larger percentage of nitrogen and most of the potash. In England and Denmark it is carted on to the fields and spread by a watering cart after rain if possible. The amount voided by a cow in twelve months is about 9 tons.

We find with all our efforts, though we clean up all the corn husks, stalks, weeds, &c., on our farms, we still need much more fibrous matter. We are mostly graziers, who milk our cattle and farm very little, and do not practice any settled rotation of crops, as they do in older lands, so that we must grow such crops as will replace those elements which are lacking, or are not assimilable.

The winter crops are mostly leguminous and the cultivation of these is always to the benefit of the land, poor soil being enriched and good soil made richer. Our heaviest rains are winter rains, and these crops prevent the soil from washing and so preserve the land from erosion.

Vetches make one of the richest of hays, carrying the same amount of protein as wheat bran, but little less carbohydrates and fats.

The crops advocated by the Agricultural Department and backed up by the wide experience of American agriculturists consist of a cereal and leguminous crop mixed. Rye and vetches, oats and vetches, wheat and vetches, and Canada or grey field peas, will give a large amount of matter for turning under, and should occasion arise that feed is needed (while not a saleable hay) for home use they give a balanced ration and a large quantity of feed. The manure made by the cattle after such feed is of better quality than from cattle, say, only grass-fed.

In the cruciferous family rape, which comes early to maturity, has a prominent place. It may with advantage be fed off once or twice, not too closely, and then the residue may be ploughed in. Its root system penetrates deeply into the soil, and the decaying roots after the crop is ploughed in, carry bacterial action down into the subsoil, and new reserves of plant food are opened up.

I have forborne mentioning any chemical manures, my desire being to impress the use of what we find to our hand, taking into account that greatest of all questions affecting the man on the land—labour and its limitations, mostly limitations.

Glen Innes.

A meeting of this branch was held on 5th February, when a paper on bee-keeping was read by Mr. C. Morton. An interesting account was given of the economy of a hive, and useful hints afforded. A sample of honey taken by Mr. Morton from a box five years ago was exhibited and admired, being still in perfect condition.

Glenfield.

A meeting was held on 25th January, when Mr. Froggatt delivered a lecture that was listened to with interest.

Glenorie.

On 26th February a discussion took place on pruning methods, and a motion was passed cordially approving of the Department's proposal that pruning demonstrations should be conducted in the same orchard for three years.

Interest was also taken in the subject of municipal markets, and some account thereof was given by Mr. W. Marcroft, who had forwarded supplies to the market and then personally followed up their subsequent movements.

Granville.

The second monthly show of flowers and vegetables was held on 19th February, with an attendance of about seventy. Mr. Kraus, of Guildford, gave a very instructive and interesting lecture on the culture of pot plants, and was most attentively listened to.

The competition in several of the sections in the show was exceedingly keen.

The membership of this branch is large and increasing, and the interest in the movement is quite a lively one in Granville.

Hannam Vale.

A practical demonstration of milk-testing was conducted on 12th February, members present expressing themselves much interested in the work. The poorest cow tested 3·0 per cent. and the best 5·4 per cent. On the whole the percentages were good, and the advisability of knowing and culling out the poor cows was apparent.

The branch met on 16th February, when a discussion took place on co-operation, members generally expressing themselves in favour of the principle.

The question whether it is more profitable for a dairyman to arrange for all his cows to come into full milk in the spring and to dry them off in the winter, or to have the cows coming in so that an even supply of milk is maintained all the year round was also discussed. The chairman emphatically favoured the latter course, referring to dairymen who adopted the former course and who gave glowing accounts of the results obtained from the good months of the year, but refrained from saying anything about the others. His own practice was to endeavour to ensure an average supply the whole year round.

Other questions were also profitably discussed.

Inverell.

At a meeting on 17th February the question of making an exhibit of weeds at the show was raised, and it was agreed that the whole of the members, as opportunity offers, collect specimens of all noxious weeds growing on their farms, and bring them to meetings, in order that they may be sent to the Department for the purpose of having every known weed in the district identified and properly named, then displayed in a suitable room in Inverell for the education of all landholders.

It was decided to make application to the Department for an officer to give a lantern lecture on noxious weeds and also on fodder crops and grasses.

The annual meeting of this branch was held on 17th February. The election of officers resulted as follows:—Chairman, Mr. J. Ditzell; Vice-chairmen, Messrs. H. Sissons and G. S. Davies; Hon. Secretary and Treasurer, Mr. W. A. Kook.

According to the chairman's report greater interest had been evinced by members during the year just ended than for a considerable time past, and it could safely be said that farmers' recognition of the value of the Bureau and the benefits that membership offered was becoming sufficiently wide to ensure the progress of the movement. The year's programme had included a number of valuable lectures and demonstrations.

Kellyville.

The branch mounted an exhibit at the Castle Hill show, but was defeated by Castle Hill, which made a big display. The exhibit was subsequently sold by auction, and the Parramatta District Hospital benefited to the amount of £6 15s. 9d.

The branch also co-operated in sending a collection of produce to the city for Bush Week.

Mr. R. N. Makin, Inspector of Agriculture, lectured before the branch on 1st March on vegetable growing, and subsequently answered quite a number of questions.

On 2nd March Mr. F. Whitehouse, M.R.C.V.S., gave an afternoon lecture on diseases of animals, receiving an attentive and appreciative hearing.

Milton.

A meeting was held on 22nd February, when Messrs. C. A. Buchan and A. A. Smart expressed their views as to the best methods of pasture improvement.

The important thing, said Mr. BUCHAN, was to maintain the fertility of the soil. This could be done (1) by proper cultivation, bringing the soil into satisfactory tilth by ploughing and even subsoiling; (2) by drainage where necessary; (3) by crop rotation; and (4) by the use of commercial fertilisers. Crop rotation of itself he considered better than green manuring. The practice of growing corn and oats year after year took too much out of the soil, and a rotation with legumes was the remedy. He suggested sowing of scarlet clover after the last scuffling of maize; this would make excellent feed for winter, and the balance could be ploughed in in the spring. Finally, the selection of tested seed, free from weeds and of high germinative quality, often made the difference between success and failure of a crop.

Mr. BUCHAN also touched on the question of silage and the conservation of fodder.

Mr. SMART discussed particularly the judicious use of artificial fertilisers, which necessitated the consideration firstly of the chemical requirements of plant life, secondly of how far the needs were already supplied by the soil, and thirdly of how far any deficiencies in the supply of the needs of particular crops might best be corrected. Different soils required different manures—one paddock that he knew of contained three different kinds of soil. The farmer who obtained the greatest success in the use of fertilisers was the one who studied the different soils and situations he had to deal with.

DEPARTMENTAL NOTE.—Attention is drawn to some very important points in the foregoing papers: the unsatisfactory condition of the pastures on many coastal farms can be remedied in the ways described. It cannot be expected that the fertility of the soil can be retained without help when there is a regular drain upon it in the shape of butter, milk, and other products, which are sold off the farm. Fertiliser must be used in the repairing of this loss, and in the experience of the Department a mixture of superphosphate and bonedust in equal parts has been found very useful. The principle of rotation of crops with pasture is a very sound one, and the use of some leguminous crop is of very great advantage, as it increases the supply of nitrogen in the soil. Scarlet clover is particularly suitable for this purpose on the South Coast. Good drainage has a very marked effect on pastures. Well-drained land gives a better growth of grass of higher nutritive quality. Consequently, the health of animals is improved and a greater production is obtained. In some cases an apparently luxurious growth occurs on damp and wet places, but such growth is generally not relished by stock and when eaten has no very high feeding value. It is quality which counts more than quantity with grasses, and every endeavour should be made according to the circumstances of the individual farm to promote a good sward of fine nutritive grass.

Mittagong.

A prominent feature of the Berrima show, early in March, was the competition open to branches of the Agricultural Bureau, in connection with which three exhibits were staged. Three local branches competed, viz., Mittagong, Moss Vale, and Penrose-Kareela. The exhibits were the most

striking feature in the pavilion, and their excellence and the general attractiveness of the display were much commented on. The exhibits were regarded as more than taking the place of a display by the Department of Agriculture. The whole reflected the resources of the district and the methods of local farmers.

The prizes offered were £25, to be divided among the exhibitors in the proportion of the points awarded by the judges, and a shield valued at £10 10s., to be won three times before becoming the property of any branch. The awards were as follows:—

	Mittagong.	Moss Vale.	Penrose-Kareela.
	Points.	Points.	Points.
Dairy produce and foods ..	60	60	55
Fruit	65	60	50
Vegetables	55	64	55
Grain	75	70	30
Hay, chaff, green fodder, ensilage	75	70	30
Wool	35	40	30
Grasses and vegetable seeds ...	75	70	30
Any other farm produce ...	10	5	...
Effective arrangement	40	50	40
	490	489	320

Moss Vale.

At the December meeting of this branch Mr. E. Breakwell, B.A., B.Sc., Agrostologist, gave a lecture on the grasses suitable for the district.

Pastures for Moss Vale District.

Mr. Breakwell treated his subject under three headings : (1) The pastures best adapted to the district ; (2) how such pastures should be established and maintained ; (3) the growth of supplementary fodder crops, if desirable.

He said the best farmers everywhere had definitely proved that variety, and, therefore, subdivision of grass paddocks produced the best results. Animals liked a change of feed, and also showed a good deal of judgment in choosing the most palatable and nutritious grasses. A paddock of good native grasses like kangaroo grass, love grass, wallaby or white top grass, produced excellent summer feed, and in a good season the excess of growth provided excellent hay. Most native grasses, however, absolutely failed in the cold months of the year. Probably the best winter grass in the State at the present time was *Phalaris bulbosa*, and the success it had met with at Orange, Bathurst, and in New Zealand guaranteed its success here if properly treated. By sowing with Bokhara clover, with which it combined very well, in the early autumn, it would be found that a good growth was made by the winter. It should not, however, be grazed until the root system was well established, and it should not at any time be grazed too closely. If this method was adopted, the pasture would last and provide excellent winter feed for a number of years. A perennial form of prairie grass and tall oat grass also promised well for winter feed, and the Department was prepared to provide free samples of seed for trial.

Spring feed was well provided for by such grasses as cocksfoot, perennial rye grass, and Kentucky blue grass—as a rule the last named germinated very slowly, and it had been shown that a winter crop such as oats should be sown with it. Although summer grasses were not in such demand as winter grasses, still such vigorous growing plants as Sudan grass and Kikuyu grass produced better results than any yet tried.

All pastures should be rested at periodical intervals, and this was easily done if the paddocks were subdivided into fairly small areas. The grasses could then seed and thicken up. Again, a pasture should not be allowed to remain down indefinitely, but it should be turned over every few years or so to clover, root crops, or cereal crops.

The value of oats as a winter cereal had already been proved. Summer crops, like maize and lucerne, should be grown wherever possible. The possibilities of lucerne had not yet been fully realised. In Moss Vale it should grow better on the sloping land, where the drainage was better, as lucerne was a plant that did not like cold or wet feet.

Mullumbimby.

Members of this branch met on 18th February, when the proposal by the Department that an orchard should be selected in which pruning demonstrations could be conducted for three successive years was approved.

Interest was expressed in the Department's proposal to issue a separate publication reporting the activities of the branches of the Bureau.

Pambula.

The feature of the meeting held by this branch on 7th March was a lecture on herd-testing by Mr. A. T. R. Brown, Dairy Instructor.

Mr. Brown divided his subject into four main headings—(*a*) what herd-testing means; (*b*) objects and benefits derived; (*c*) financing and method of raising subscriptions; and (*d*) conduct of the scheme. Each of these aspects was clearly and thoroughly dealt with.

A district exhibit by members of this branch was erected at the local show held on 9th February. The exhibit attracted much favourable comment.

Rydal.

A meeting was held on 22nd February, when a paper, entitled "Pigs for the Farmer," was read by Mr. L. B. Prior. The following paragraphs are taken from the paper:—

PIGS FOR THE FARMER.

The commercial possibilities of this branch of mixed farming are perhaps greater than any other branch, but the subject is so very little known amongst the average run of mixed farmers that Australia becomes less of a pig-raising country each year. It is a fact that in the last ten (10) years the number of pigs has fallen from one and a half millions to about half a million.

The only large pig-raising countries in the world are the United States, Canada, and Denmark, and they cannot possibly satisfy the enormous demand. It is only because of lack of encouragement on the part of our various Governments that Australia does not take her place in the ranks of the world's pig-raisers.

In this country, where we have extremes of weather, we certainly need a very hardy pig, and there is no doubt the Berkshire answers that purpose very well. Then we have the Yorkshire—a white pig, but which will not, unfortunately, stand either extreme heat or extreme cold. The Tamworth, a native of England, is a very hardy animal and should thrive in this district very well; but a Tamworth, in my opinion, is a pig which is only suitable for the farmer who makes a speciality of pig-raising. It requires much more care and attention than the average mixed farmer can afford to give it. Climate influences pigs very much; if it were not for the severe winter in this district I would say that some of the American breeds—Poland China, Chester White, or Duroc Jersey—would be highly profitable, owing to their great weight at maturity.

Let us take the Berkshire as our pig (and we will not be far out in doing so), and begin a herd. First we have to select the suitable sow and boar. The Berkshire, a native of England, was first introduced into the United States in the eighteenth century, and was improved in that country by crossing it with Asiatic pigs. The colour was improved from a half-black spotted with white and brown to the present-day black with occasionally a tinge of bronze or copper colour, white on the feet, face, and tip of tail, and occasionally a splash of white on the arm. The snout should be short and broad and dished, and the face broad between the eyes. Hair should be fine and soft, and set on a smooth

and pliable skin. The back is broad, long, and straight; it may on some occasions be slightly arched, but one must guard against the sloping or sagging back, both weaknesses being a sure sign of degeneracy.

The sow which is a generous milker, prolific with her litters, and of quiet, gentle disposition, is certainly the sow for the farmer to acquire, even though she cost a little more. A good breeding sow is a roomy animal with a long, deep body and fully developed hindquarters and pelvic region. Her legs should be short and strong, but entirely free from undue coarseness, and she should carry at least twelve evenly-placed and evenly-formed teats.

The breeding sow, when pregnant, must have plenty of exercise. If she is shut up in a small, poorly ventilated, and ill-kept yard she will not bring fine, healthy litters into the world. A sow is more likely to become barren through over-fatness than any other cause. In such a case, if she is not too far gone she can be brought round by careful and judicious dieting. The boar should be then placed in an adjoining pen where he can see and smell the sow. If this treatment does not bring her round she should be topped off and killed, as a barren sow is only an expense on the mixed farm. A sow will breed when she is eight or nine months old, but it will be found more profitable, if it is possible to do so, to keep her until somewhat older. The litters of sows between twelve and eighteen months old are usually small, and the young do not make the headway noticeable in litters produced by older sows. It has been established that a sow which produces less than seven at a litter is hardly worth while keeping for breeding unless she is a remarkably fine type of animal.

It is even more important to have a really good boar, as he is the sire for many sows. No matter how good-looking a boar may be, if he has no breeding of any account in him it is only ruining the future of the herd to breed him. Even if he is well bred, and has been starved or overfed, or perhaps overworked by a previous owner while young, his progeny will be a weak and degenerate lot. What may be termed the first point in the selection of a boar is not only is he well bred, but has he had good management from the day he was born? Masculinity is a characteristic which must always show great prominence, and this is indicated by strength and vitality, but need not and does not mean coarseness in build. Broad hams and shoulders, a good girth, strong legs and upright feet are main points in the choice, and a clean elastic skin, with soft, smooth hair free from all roughness and hard bristles denotes a good, healthy constitution. It is imperative that he should have a quiet disposition. A bad-tempered boar is very often the sign of a short-tempered owner; and I feel sure that you will never regret spending what you may consider very valuable time in treating your boar with great patience. The boar may be used for service when he is 9 months old, but it is not advisable for him to be allowed more than two sows at this age. When he is past his 12 months then it will be safe to have reasonable service; and if he is well cared for he will be at his best for stud purposes from 18 months to 5 years. Between the age of 2 and 5 years. American breeders consider sixty sows a season a fair thing for any boar, which is rather more than in Australia.

Good housing applies, of course, equally to the sow and the boar. To house a pig comfortably to the best advantage, an elaborate building is not necessary. The average farmer need only see that ample light, warmth, and shelter are available. It is necessary, however, that the sty and its run are thoroughly drained and kept very clean. Nothing breeds disease quicker than an accumulation of dirt and filth, and no animal is more susceptible to disease than the pig. The building should be placed on a sandy or gravelly soil, in preference to a loamy or peaty soil, as the former provides a natural drainage. It is advisable to floor the sty itself when suitable material is available. A very sad mistake, which quite a number of pig-raisers have made, is to concrete the floors. Of course, concrete can be kept nice and clean, but pigs are rather susceptible to rheumatism, and a concrete floor will give it to them if they are at all inclined that way. Stone or brick, owing to their greater warmth, make a much more suitable floor, although not as neat. If the sty is floored in this manner, it is advisable to have an overlay or second floor built of wood, which fits into a corner of the sty and which can be easily removed and cleaned.

The matter of feeding properly and scientifically has been sadly neglected by farmers in this country. The pig is rightly credited with the ability to use up

nearly everything in the way of food, and sometimes unwholesome food is used, just because the victim happens to be a pig. The pig has been called "the farm scavenger," but it must be borne in mind that when the animal is allowed to runt about for its food, prime quality pork and bacon cannot possibly be expected. Certainly the digestive powers of the pig are marvellous; but any old food is not good enough if choice flavour and good curing qualities are desired. Food has much more influence on the flavour of the flesh in this animal than in any other animal, and scientific feeding will certainly repay the farmer. A fact that is usually overlooked in pig-feeding is that the pig is just as much a grass-eating animal as the horse or sheep, and as grass is an aid to digestion it is not right that the pig should be deprived of its natural corrective. American farmers were the first to put into practice the idea of grazing pigs just as one would graze sheep. All that is necessary is a movable sty and a supply of water. The sty is usually on the same lines as a huge dog kennel, mounted on slides to enable it to be moved from one part of the grazing paddock to another. In America pigs are grazed on lucerne. Farmers in this district have remarked to me on several occasions, "Yes, when green feed is available feeding may not be a problem, but what about winter time?" Well, in winter time perhaps the greatest attention is necessary. Root crops, pumpkins, lucerne hay, and clovers are undoubtedly the best foods available in this country. Potatoes and artichokes offer the best succulence, and also have the laxative qualities of green feeds, but care must be exercised when using these foods as their laxative effects are sometimes too great. Then another good substitute for green feed—just as good for a horse as a pig—is steamed chaff. The idea is to get a cask or large box, drill half-inch holes in the bottom, fill it with a mixture of chaff and bran or any other by-product of wheat or oats, and pour a bucketful of boiling water over it. Throw several bags over the top to prevent the escape of steam and in twelve hours you have a very palatable and a very corrective food.

Consumers nowadays desire more lean and less fat on pigs than formerly, but this lean is not produced by scanty feeding; it is produced by scientific feeding, which produces the alternate streaks of fat and lean. The first 100 lb. of pork costs very little to produce in a well-bred pig; 1½ lb. of grain per day will maintain a pig at this weight, but if the ration is increased to 4 lb. of grain per day, the increase in the weight of the animal is 1 lb. per day. Grain alone, however, should not be fed to pigs; either green feed or steamed chaff should be given as a preventive against "balling" in the stomach.

Pigs are very partial to charcoal, as it supplies the mineral matters necessary for the production of firm flesh. Feeding a little treacle dissolved in hot water with the food occasionally will have the effect of imparting a sweetness to the flesh. Although at birth the young pigs weigh only from 2 to 3 lb. each, they will weigh from 18 to 20 lb. each at 6 weeks old if the mother has been properly fed. With the separated milk usually available on the mixed farm, the fattening of pigs is a very simple matter. Separated milk must not be fed to pigs until it is at least 12 hours old, as it is full of minute bubbles which are extremely likely to cause diarrhœa. Topping off a pig ready for killing is accomplished in anything from two to three weeks, by using a purely grain ration with just the amount of greenstuff necessary to ensure the absence of grain "balling" in the stomach.

No paper on pigs is quite complete without a few words on diseases. Of course, prevention is the best policy always, and the best way to prevent disease is to raise pigs of strong vitality. This is accomplished by using only strong and pure breeding stock which are not closely related, feeding in such a way that the organs of the animal are in natural working order, and keeping the surroundings of the animal clean.

Perhaps the most deadly disease in existence in the pig world is swine fever or swine plague. It is communicable by means of food, by means of persons who have been in contact with diseased pigs or their sties, and it is even communicable through the germs being distributed in the atmosphere. Animals that become affected show dulness and thirst, and develop red spots on the head, neck, and ears, and occasionally about the thighs and tail. The animal is inclined to hide itself wherever possible, or to get into a corner, and lie on its belly, for there is great weakness in the limbs. The snout is dry and

spotted red. On account of the contagiousness of this disease treatment is out of the question, and the animal must be slaughtered and burnt, and all pigs which have been in contact with the diseased animal must be immediately quarantined and watched. The sty must be destroyed by burning, and that portion of ground never used again for pigs. Any instruments, knives, &c., must be sterilised by washing with one part carbolic acid to twenty of water. All this may seem needless, but this is the most deadly of all pig diseases, and the precautions are only fair to the breeder and his neighbours. Strangely enough, this disease has not yet been discovered among any other animals. It appears to be wholly and solely a pig disease.

Tuberculosis is another serious disease, although it is not very often found in pigs. This disease has not got the outstanding symptoms of swine fever, but a swelling may be noticed in the neck and joints, accompanied with diarrhœa. The animal will show loss of condition and generally dies in a very short time. The main source of contagion is feeding on skimmed milk from a tuberculous cow, and it has been known for an affected pig to pass its disease on to a human being. Slaughtering and burning is about the best thing I know of for a tubercular pig.

Diarrhœa is usually only found in pigs which are suckling or which have only lately been weaned. The causes are poverty of the mother's milk, improper food, cold and damp sties, and sudden changes in the weather. Green food given to sows with litters when they have long been without it is not an infrequent cause. Young pigs that are affected, if old enough to eat, should be given a dry mixture of flour and arrowroot; grown animals should be given dry grain and sweet skimmed milk. Soot mixed with the food is also a very good cure.

Constipation is merely an indication that a change of diet is necessary. Withhold all solid food for twenty-four hours and feed on a mash for that period. Then give a tempting mash in which is mixed four tablespoons of Epsom salts. A pig which is regularly fed and has plenty of green feed is, however, very little troubled with this complaint.

Inversion of the rectum or protruding anus is a fairly common complaint with pigs. It generally affects those which are badly fed and housed, although it sometimes arises through constipation and farrowing. The best thing to do is to empty and clean the protruding part as soon as it is noticed, and using warm water or oil push the protruding part back. The animal must have no solid food for a couple of days after this. If constipation is the cause, 2 oz. of castor oil should be given.

Some breeders have had pigs lose their tails. This is due to sores caused through dirty sties and nesting places. If the sores are not too fully developed, they may be treated with lard with which is mixed a little drop of carbolic acid. Cleanliness, however, is the preventive in this case.

Tennyson-Kurrajong.

This branch has taken a fresh lease of life, and on 6th December elected the following officers for the year:—Chairman, Mr. H. A. Wood; Vice-chairman, Mr. R. Allison; Treasurer, Mr. A. McMahon; Hon. Secretary, Mr. H. S. Farlow.

Twelve of the members visited Hawkesbury Agricultural College on 21st January, an instructive and enjoyable time being spent.

During February Mr. W. le Gay Brereton, Assistant Fruit Expert, delivered a lecture on fruit pests and their control, being listened to by a large number of members. A number of questions were answered subsequently, and the event proved a very profitable one.

The monthly meeting was held on 7th March, when Mr. H. A. Wood, district Fruit Inspector and chairman of the branch, gave an instructive lecture on the preparation of land and planting for an orchard. This branch anticipates the swelling of its membership by a number of soldier settlers shortly.

Tingha.

The monthly meeting on 5th March was well attended, notwithstanding heavy rain. Several items of business were dealt with, and, among other things, it was decided to invite public discussion of the advisabilty of forming a Pastoral and Agricultural Association to conduct future shows in the district.

A programme of lectures and demonstrations on useful subjects has been arranged for the ensuing three months.

Warrah Creek.

A meeting was held on 17th February, when good progress by the working-bee with the clearing of the recreation ground was reported.

It was decided to ask the Pastures Protection Board to erect or assist in the erection of a sheep-dip.

The question of lamb-raising was raised by the reading of a short paper from the *Agricultural Gazette*; several farmers believed a Lincoln ram would leave as many twins as a Border-Leicester.

Wellington.

A special meeting was held on 11th February, when the business was chiefly the resignation of the Secretary, Mr. L. Jurd, and the appointment of a successor. The resignation was received with expressions of regret, and a presentation was made to Mr. Jurd as a mark of appreciation of his services to the branch. Mr. H. E. Hobson was appointed Hon. Secretary.

Preliminary arrangements were made with a view to a district exhibit at the local show.

Messrs. Kimbell and Flanagan gave an account of the Orange conference of Bureau delegates.

Wentworthville.

A lecture on leguminous plants was delivered under the auspices of this branch on 2nd February by Mr. R. N. Makin, Inspector of Agriculture.

The habits of legumes were described, the fixation of nitrogen on their roots by symbiotic bacteria, their value as a rotation, and also for green-manuring purposes.

Wetherill Park.

Mr. C. C. Crane, Organising Inspector, visited the branch on 14th January, and delivered a lecture that was evidently appreciated by hearers.

The secretary of this branch reports enhanced interest in its activities, and the staging of an exhibit at the Fairfield show.

A discussion took place at the last meeting on the mortality among cattle grazed on Sudan grass, and the Department was applied to for information on the subject, as a good deal of Sudan was being grown in the district. In reply to this inquiry the Agrostologist remarked that the case so much discussed in the press of late was the only one of the kind known. It was advisable, however, that hungry stock be not grazed on young Sudan grass.

Yarrunga-Avoca.

The branch met on 22nd January, when a good deal of routine business was transacted. Arrangements were advanced for several useful fixtures. An effort is being made to arrange for a lecture and demonstration on blacksmithing for farmers. The Department has pointed out that the most satisfactory instruction would be obtained by members taking the blacksmith's course at the Winter School at Hawkesbury Agricultural College.

The model beehive is at present in circulation among members.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1921.

Society.	Secretary.	Date.
Coonabarabran P. & A. Association	Geo. B McEwen...	April 7, 8
Upper Manning A. and H. Association (Wingham)...	D. Stewart ...	,, 13, 14
Narrabri P., A., and H. Association	C. C. Baker ...	,, 13, 14, 15
Orange A. and P. Association	G. W. Williams ...	,, 13, 14, 15
Clarence P. and A. Society (Grafton)	L. C. Lawson ...	,, 13 to 16
Wellington P., A., and H. Society	A. E. Rotton ...	,, 19, 20
Dubbo P., A., and H. Association	F. Weston ...	,, 27, 28
Hawkesbury District A. Association (Windsor) ...	H. S. Johnston ...	May 12, 13, 14
Murrumbidgee P. and A. Association (Wagga) ...	A F. D. White ...	Aug. 23, 24, 25
Corowa P., A., and H. Society...	J. D. Fraser ...	,, 30, 31
Forbes P., A., and H. Association	E. A. Austen ...	,, 30, 31
Grenfell P., A., and H. Association	G. Cousins ...	,, 30, 31
Cowra P., A., and H. Association	E. P. Todhunter	Sept. 13, 14
Cootamundra A., P., H., & I. Association	C. H. Inson ...	,, 14, 15
Northern A. Association (Singleton)	J. T. McMahon ...	,, 15, 16, 17
Temora P., A., H., and I. Association ...	A. D. Ness	,, 20, 21, 22
Henty P. and A. Society	H. Wehrman ...	,, 27, 28
Deniliquin P. and A. Society	P. Fagan	,, 28
Narrandera P. and A. Association	W. Cantong ...	Oct. 11, 12
Lismore A. and I. Society	H. Pritchard ...	Nov. 23, 24

TO TREAT SNAKE BITE IN STOCK.

SNAKE-BITE in stock usually passes unnoticed, the animal being found dead. Lines of treatment can, however, be suggested if a case comes under observation before death.

If bitten about the face, or such thin-skinned parts, there will be a marked swelling, and possibly the marks of the teeth may be detected on careful examination. If, however, the animal is bitten about the legs, the swelling will not be so marked, and may be unnoticed—the real cause being unsuspected. The general symptoms are drowsiness, due to depression of the heart, sometimes followed by paralysis, unconsciousness, convulsions, and death.

When it has been ascertained where the animal has been bitten the bite should be ligatured, if possible; it should then be scarified or cut out, and permanganate of potash rubbed well in. The general treatment is the administration of large doses of one or other of the following stimulants:—

1. Hypodermic injections of strychnine—an eighth to a half grain, according to the size of the animal. These should be given at regular intervals to prevent the animal becoming too drowsy.

2. The administration by the mouth of large doses of alcohol—brandy, whisky, rum, &c.

3. The administration by the mouth of large doses of ammonia, preferably the strong liquor ammonia sold by chemists, $1\frac{1}{2}$ to 4 drams (according to the size of the animal) diluted with at least forty times its volume of water.

Intervals of at least two hours should separate the application of such treatments, which should be repeated until the effect of the snake bite poison has been overcome.—VETERINARY OFFICERS of the Stock Branch.

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Agricultural Gazette of New South Wales.

Bulk Handling.

L. S. HARRISON, Acting Chief Inspector, Grain Elevators Branch.

SOME remarks and points noticed in this year's working of the bulk-grain system should be of interest at the present time, since strong opposition was shown to it by interested parties at the commencement of the season, whereas the majority of farmers in the districts where elevators have been in operation are now staunch converts to the advantages of handling their products in bulk. This year's operations were of necessity largely experimental, since storage bins only, without working houses, were in use, while staffs had to be trained, and unknown conditions, in which the experience of older countries did not assist, had to be contended with.

The f.a.q. basis of receiving and disposing of wheat is admittedly at fault, as it offers no monetary incentive for improving the quality of the product, and as it operates at present it probably has a retrogressive effect in this respect. With an up-to-date and suitable grading system peculiar to Australian requirements, a grower will be paid for the exact quality of the product he supplies, as grades will be arranged for every class of wheat delivered to an elevator; this will quickly tend to improve farming methods, and with improved methods to safeguard quality, an increased acreage yield will be the natural sequence. A disinterested grading and weighing system will also eliminate any possibility of all the profits not reaching the grower.

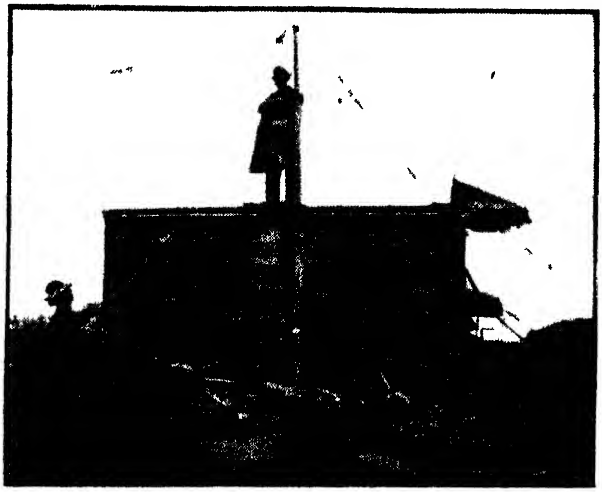
The fact that there is only one handling in the present bulk system speaks for itself, and once the wheat is in the bins it gravitates or is elevated to trucks, from which it is unloaded at the terminal and conveyed by machinery to the storage bins and thence direct to the vessel's hold, thus effecting an immense saving in handling and time, and as a result a decreased cost.

When the wheat is bulked at the country stations it is perfectly secure from weather and weevil, mice, and other vermin, and may be held there or trucked away with absolute safety. Unquestionably much wheat that is bleached regains condition after being stored for a period, and improves largely in colour and appearance, while in temperature it shows an almost imperceptible variation once it is placed in the bins, providing, of course, too much moisture is not present, which fact is easily determined and corrected by moving and turning the grain from time to time; while the moisture content of wheat is maintained at not more than 10 per cent., wheat cannot itself deteriorate, nor can weevil thrive in it.

No doubt bags will continue to be used in our bulk system for some time to come, and if they can be retained on the farm much saving will result, as wear and tear will be reduced to a minimum, and they may be used over and over again, a very few bags proportionately being required to handle a

A

farmer's harvest The sacks can be filled at the harvester and loosely tied, and subsequently tipped into a bulk or tank waggon to be carted to the station. Some pioneering work in the matter of waggons has been done this year, and the accompanying illustrations will be of interest, as they show the



Bulk waggon being loaded at the farm

The same waggon being unloaded at the station.

first waggon used in New South Wales to convey wheat in bulk to a country elevator. It was built on the farm of Messrs McMaster Brothers, of Walbundrie, who supplied their wheat to Burrumbuttock. Discharge is effected by means of a shute running direct from the bottom of the waggon to the hopp

Under this system the bags do not require to be rammed and sewn. At the present time this process is a costly item to the wheat-grower, and occupies a considerable amount of valuable time. If, however, the bags have to carry the wheat only to the station, they may be filled so that the mouths can be tied, or they can be filled closer to the top and roughly sewn, or, again, the two sides of the top of each bag may be simply turned over and pinned together with two skewers. These skewers can be made by filing a point on one end of a piece of wire (old No. 8 fencing wire for preference) and turning back about 2 inches of the other end so as to form a rough loop that will enable the skewer to be used with ease when the bags are being secured on the farm, and also when pulling out at the elevator; one skewer should be pushed in from either side so as to pin the top together and to overlap about 2 inches in the middle, and they can be taken out and used time and time again.

Doubtless as time goes on storage will be arranged on the farm for bulk grain by the erection of bins of cheap material in which it can be placed until it is ready to be removed to the elevators.

The Agricultural Vote in Canada.

The total appropriation placed at the disposal of the Federal and Provincial Departments of Agriculture (Canada) for the fiscal year, 1920–21, approximates the sum of 10,000,000 dollars, as denoted by the following table:—Department of Agriculture of Canada, 5,020,000 dollars; "The Agricultural Instruction Act" (Federal), 1,100,000 dollars; Prince Edward Island, 1919–20, 20,170 dollars; Nova Scotia, 111,450 dollars; New Brunswick, 118,181 dollars; Quebec, 899,500 dollars; Ontario, 1,594,540 dollars; Manitoba, 582,490 dollars; Saskatchewan, 282,014 dollars; Alberta, 538,100 dollars; British Columbia, 375,736 dollars. Total, 10,642,181 dollars.—*The Agricultural Gazette of Canada.*

The True Worth of a Cow.

In a Missouri cow-testing association there was a man who, when he entered the association, did not appear to have a very good herd; but among his cows was a crippled ten-year-old Jersey named Goldie. Old Goldie led the whole association, with an annual production of approximately 9,300 lb. of milk and 526 lb. of fat, and an income over cost of feed amounting to 267 dollars, in spite of the fact that when the test started she had already gone three months since freshening. The amusing part of Goldie's record is that her owner tried to sell her just before she went on test for 75 dollars. Six months later he refused 275 dollars for her.

The whole herd of which Goldie was a part averaged over 360 lb. of fat for the year. In contrast with this was another herd of thirty-seven cows in the same association, which had been reputed to be the best in that part of the State. Yet fourteen of these were sold during the year as unprofitable, and it seemed likely that more of them would be.—*Weekly News Letter* of U.S.A. Department of Agriculture.

Trials of Canary Seed.

During the season 1920-21 trials with canary seed were conducted on several experiment farms, with results that on the whole were fairly satisfactory. The crop is not one that would be sown on a large area, but it requires no special attention in growth, and little extra trouble in harvesting and threshing. The reports concerning the various trials were as follows:—

Mr. C. W. Kennedy, Manager, Condobolin Experiment Farm.—The seed was sown on an area of three-quarters of an acre through the fertiliser runs of the grain drill at the rate of 12 lb. per acre. On 2nd June 50 points of rain fell; this gave the crop a good start. It made slow progress during June, July, and August, but made up very rapidly in September and October, and ripened early in December. Heavy rain caused a small portion of the crop to lodge, but this did not make much difference to the stripping, as the straw is tough and stands up well to the machine. The seed was stripped and cleaned with the winnower, 312 lb. seed being gathered.

Mr. E. S. Clayton, Experimentalist, Wagga Experiment Farm.—A plot of canary seed, 1 acre in area, was sown on the red loam soil of the farm. The seed was mixed with fertiliser, and sown through the manure box of the wheat drill, at the rate of 10 lb. per acre; 56 lb. superphosphate per acre was also applied. The weather prior to sowing was extremely dry, consequently the germination was unsatisfactory. The drought broke in June, and good rains were received right up to harvesting, but weed growth (particularly Cape weed) was very troublesome, and prevented the crop making normal growth. The crop was harvested with a combined harvester on 24th December. The yield of grain was low, only 190 lb. being obtained from the acre.

Mr. H. C. Stening, Manager, Temora Experiment Farm.—A plot of ·92 of an acre was sown on 10th May, at the rate of 10 lb. per acre, and manured with superphosphate at the rate of 50 lb. per acre. The growth was very satisfactory, except in waterlogged depressions, although germination did not take place until after the June rains. The yield of seed from the plot was 602 lb., which is equal to 654 lb. per acre.

Mr. C. McCauley, Experimentalist, Cowra Experiment Farm.—An area of five-eighths of an acre, which had been disc-ploughed early in January and spring-tooth cultivated in February, was sown with the wheat drill at the rate of 12 lb. seed per acre on 19th April, 1920. Superphosphate was applied at the rate of 60 lb. per acre. The seed germinated well on 30th April. The early growth was rapid, the crop making better growth than either wheat or oats, and it should prove a good winter fodder. The crop continued to make good growth, and at harvest time was 5 feet high. The rainfall during the growing period was:—May, 6 points; June, 568; July, 262; August, 324; September, 234; October, 304; November, 155; total, 1,853 points. The crop was in flower on 19th October, and ripened on 18th November. The yield was 456 lb., which is at the rate of 730 lb. per acre.

The reports from Glen Innes and Bathurst farms are not yet to hand, but the indications are that a very fair crop obtained at the former and a poor one at the latter.—R. G. Downing, Senior Experimentalist.

Farmers' Experiment Plots.

Potato Trials, 1920.

Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Assistant Inspector of Agriculture.

The undermentioned settlers co-operated with the Department in carrying out trials with potatoes during the spring of 1920:—

W. Evans, Farm 138, Stonypoint.
A. D. M'Keller, 327, Leeton.
P. Gersbach, Farm 330, Wamoon.
F. Gersbach, Farm 864, Stanbridge.

In arranging these trials on the various farms, care was exercised to select different types of soils. In the case of Mr. Evans' farm, the heavier class of land was selected with the idea of demonstrating that, with proper and thorough cultivation and irrigation, potatoes can be grown profitably on other than the sandy soils of the area. There is less risk of failure on the lighter soils, but the tubers grown on the heavier soils are of much better quality, and this season the yields were also heavier.

The Season.

From the potato-growers' point of view, it can safely be said that ideal conditions prevailed throughout the growing period. Splendid falls of rain were recorded, and only at odd periods of short duration were the temperatures high. Prior to planting, good rainfall registrations were made; and, although these allowed of the land to be ploughed, in many instances a thorough preparation, while not absolutely impossible, was retarded to a certain extent, and later, owing to the wet condition of the soil, the planting was somewhat delayed.

The rainfall registrations during the growing period were as follows:—

September, 286 points.	October, 166 points.
November, 153 ,,	December, 386 ,,

Farm 138.—This soil consists of a red clay loam, and by many would be considered rather on the heavy side; but the results obtained clearly demonstrate that, given suitable treatment and favourable weather conditions, this class of land is eminently suited for potato-growing. Sudan grass had been previously grown on the plot and fed off with sheep. A quantity of sorghum had also been cut and fed on the land, thereby increasing its fertility.

The plot was deeply ploughed and harrowed in July and well cultivated in August. At planting time the land was again ploughed and the sets

were dropped by hand in every fourth furrow, or 3 feet apart, and 15 inches apart in the rows. This operation was carried out in the case of the variety trial on 23rd August, and with the fertiliser portion of the experiment on 30th August, the delay being due to a fall of rain making the land too wet to continue planting. Superphosphate, at the rate of 2 cwt. per acre, was used in the variety trial.

The manures used in the fertiliser trial were superphosphate, M5 (two parts superphosphate and one part sulphate of ammonia), and P7 (equal amounts of bonedust and superphosphate), while an unmanured plot was used as a check. That portion to which P7 was added gave the heaviest yield—an increase of 2 tons 9 cwt. 2 qrs. 12 lb., giving a monetary gain over the cost of the manure of £28 16s. 9d. Potatoes were then selling locally at £12 per ton.

A very good germination was obtained, the potatoes making rapid growth. The cultural operations during growth were:—30th September, harrowed; 16th October, cultivated and hilled; 21st October, cultivated and furrowed for irrigation, but owing to a fall of rain the water was not turned on; 27th October, cultivated; 2nd November, irrigated, and cultivated as soon as the land was dry enough; 21st November, both operations were repeated.

It should be pointed out and particularly observed, that it is advisable when cultivating after the plants have been hilled, so to use the hillers on the machine as to increase the size of the hills rather than to diminish them, as the broader they are the smaller the chance of drying out and the more protection given the tubers. It was very noticeable at digging time that when a broad hill was met the soil in the centre was loose and mellow, whereas when a narrow hill was encountered the soil was hard and dry and the tubers had suffered severely in consequence.

Farm 327.—This plot was planted on the lightest soil in the trials, but very satisfactory results were obtained. A variety trial was conducted, and both whole and cut seed was used; taken as a whole the cut seed gave the best results.

The previous crop, oats without manure, had been grazed off. The land was ploughed in August; then harrowed and cultivated. Similar operations were carried out at planting time as with the previous trials.

A better germination could not have been obtained, and the haulms made very rapid growth. The crop was irrigated on two occasions; thorough cultivation was practised between times, and large hills were formed round the plants.

Farm 330.—The land on which this trial was conducted consisted of a red sandy loam. The previous crop had been potatoes in the spring of 1919, since when the land had been fallowed.

The land was ploughed in August, harrowed, and cultivated. Furrows were struck 3 feet apart, and after the sets and fertiliser had been put in the drills the land was lightly cultivated and harrowed. Planting was carried out on 2nd and 3rd September, 1920.

These potatoes were rather slow in germinating, but a very good growth was made later. The cultural methods were :—September, harrowed ; 5th October, cultivated ; 14th October, cultivated and hilled ; 25th October, watered ; 29th October, cultivated and hilled ; 5th December, watered.

In this test a plot of whole Up-to-Date seed yielded heavier than the cut seed, whilst the plot of Manhattan gave 94 per cent. of marketable tubers.

Farm 864.—New land of a sandy nature was used in this trial. It was ploughed, harrowed, and cultivated in July and August, but owing to the wet state of the soil the planting was not carried out until 1st October. Both variety and manurial tests were conducted. The yield from the Up-to-Dates in the fertiliser trial was much heavier than those obtained from the other varieties. Two waterings were given during the growing stages, the land being also cultivated and hilled.

The following notes were taken on the seed at planting time :—

Up-to-Date.—A very good sample of seed ; very few required cutting ; nicely sprouted.

Factor.—Large seed, necessitating cutting ; owing to the small number of eyes the sets had to be cut on the large size ; fairly sound ; sprouted.

Early Manistee.—These were also on the large size, with very few eyes.

Early Rose.—This seed was a good size for whole sowing ; very sound and also well sprouted.

Satisfaction.—Very sound, but rather backward for planting : very few required cutting.

Carman No. 1.—Very large seed, necessitating waste in cutting ; strong shoots in right condition for planting.

Manhattan.—Very good seed ; sound, numerous eyes, but rather backward with sprouting.

General.

With the spring planting it is preferable only to plant shallow, say 3 to 4 inches at most ; the soil being cool there is not a great danger of the sets drying out before the young plants appear. This also applies to planting cut seed at this particular time of the year, whereas, with the autumn planting, it is advisable to put the sets deeper in the soil to prevent drying out. When once the plants have made good growth it is most essential that they be kept growing, and on no condition should the soil be allowed to become dry, as, if this occurs, the plants receive a check, the tubers mature, and if rain falls or another irrigation be given, second growth is the result. By keeping the soil moist the temperature is also kept lower.

When irrigating one should, as far as possible, endeavour to avoid watering during a hot period. If possible pick a cool day for this operation ; even if such a day comes along when the grower is of the opinion that the plot hardly requires water, he should avail himself of the chance and water while the weather is favourable.

RESULTS of Variety Trials.

Variety.	Farm 138.					Farm 327.					Farm 330.					Farm 864.				
	Yield.				Per cent. of M.P.*	Yield.				Per cent. of M.P.*	Yield.				Per cent. of M.P.*	Yield.				Per cent. of M.P.*
	t.	c.	q.	lb.		t.	c.	q.	lb.		t.	c.	q.	lb.		t.	c.	q.	lb.	
Up-to-Date	8	17	3	18	87·73	7	3	3	0	61	7	3	1	16	77	7	10	3	16	74·1
Factor	8	9	2	18	86·43	5	11	3	14	62	6	5	3	18	83	5	10	0	0	75·3
Manhattan	8	2	2	11	93·69	4	0	2	14	80	6	3	0	18	94	4	6	1	20	85·2
Early Rose	7	15	2	22	88·22	6	13	3	0	70		..			..		..			..
Early Manistee ..	7	0	1	27	90·81	4	15	2	14	77		..			..		..			..
Satisfaction ..	6	19	3	9	88·76	4	15	0	0	71	4	17	3	8	87	2	17	3	22	73·0
Carman	6	4	3	14	91·76	4	7	2	0	69		..			..	4	16	1	0	75·5

* M.P. signifies marketable potatoes.

RESULTS of Fertiliser Trials.

	Fertiliser and amount.	Yield.				Increase due to Fertiliser.				Value of Increase.			Cost of Fertiliser.			Profit due to Fertiliser.		
		t.	c.	q.	lb.	t.	c.	q.	lb.	£	s.	d.	£	s.	d.	£	s.	d.
Farm 138.	2 cwt. P7	7	1	3	5	2	9	2	12	29	15	3	0	18	6	28	16	9
	2 cwt. superphosphate ..	6	16	1	18	2	4	0	25	26	10	8	0	13	0	25	17	8
	2 cwt. M5	6	8	1	25	1	16	1	4	21	3	5	1	2	2	20	1	8
	No manure	4	12	0	21		......				...			....			....	
Farm 330.	2 cwt. superphosphate ..	5	12	3	22	1	0	0	4	12	0	5	0	13	0	11	7	5
	4 cwt. superphosphate ..	4	17	0	16	0	4	0	26	2	10	10	1	6	0	1	4	10
	No manure	4	12	3	18		......				....			....			....	
Farm 864.	1 cwt. superphosphate ..	7	10	3	16	1	11	1	20	18	17	1	0	6	6	18	10	7
	2 cwt. superphosphate ..	7	9	3	18	1	10	1	22	18	5	4	0	13	0	17	12	4
	2 cwt. M5	6	13	3	24	0	14	2	0	8	14	0	1	2	2	7	12	10
	2 cwt. P7	6	6	1	0	0	6	3	4	4	1	5	0	18	6	3	2	11
	No manure	5	19	1	24		.....				....			....			....	

P7 consists of equal parts of superphosphate and bonedust; M5 consists of 2 parts superphosphate and 1 part sulphate of ammonia.

The produce of these plots was sold at up to £14 per ton, and averaged £12.

TO STORE PARSNIPS.

THE best method of storing parsnips is to cut the tops off, but not right up to the crown. In heaping up, the thin end of the roots should point to the centre of the heap when stacking, and by placing the parsnips in layers the heap will gradually round itself off. All roots should be free from any dew or rain-water at the time of stacking. When the stack is complete cover with straw, then draw a good covering of earth over, and make it firm by patting with a spade.—A. J. PINN, Inspector of Agriculture.

THE cultivation of millions of acres of succulent plants has provided a new and never-ending food supply for the insect world. The more food man grows for himself, the more he provides for insects and small vermin.—Mrs. RUBY R. MILLS, in the *Agricultural Gazette of Canada.*

A Promising Introduction.

KIKUYU GRASS (*Pennisetum longistylum* Hochst).

J. N. WHITTET, Assistant Agrostologist.

ALTHOUGH kikuyu has not yet exhibited any signs of forming seed in New South Wales it was first grown here by the Agrostologist from seed received from the Belgian Congo. In Rhodesia and in different parts of the Union of South Africa, it is propagated by means of "roots" or cuttings, owing to no seed heads forming.

The seed was planted at the Botanic Gardens, Sydney, in the early part of 1919, and sufficient cuttings were thereby obtained to enable plot to be planted at Hawkesbury Agricultural College, Richmond, and from these two sources a considerable number of "roots" and cuttings have now been distributed for trial to experiment farms, private farmers, and pastoralists in this and other States.

All reports received to date show that kikuyu is giving very good results, especially in the coastal districts of New South Wales.

A Rapid Grower.

The illustration showing cows feeding on an area of kikuyu gives some idea of the rapidity of the growth made by this grass. This area was planted with rooted stolons on 30th January, 1920, at Hawkesbury Agricultural College, Richmond, but owing to very dry conditions occurring in August, September, and October (only 205 points of rain being the total registered for the three months) very little progress was made by the plants. In November and in the early part of December, the rainfall was fairly plentiful, and the grass rapidly made growth. The cows were turned into the area on 21st December, at which time the growth had attained a height of 3 feet, and in some cases 4 feet, but owing to the weakness of the stems when 2 to 3 feet high, the grass invariably lies over.

The cuttings were planted 3 feet apart each way in the field, and given favourable conditions would cover the intervening ground in a couple of months.

Climate and Rainfall.

In South Africa, farmers have found that kikuyu grass adapts itself very readily to varying climatic conditions. Although mainly a spring and summer grower, it also withstands a considerable amount of cold and keeps fairly green in spite of heavy frosts. This condition of things was found to be the case at Hawkesbury Agricultural College; there the frosts are fairly severe in May, June, and July, and the top section of the kikuyu plot was cut

back a little, but where drainage water accumulated at the lower end the grass remained fairly green and succulent right through the winter. At Grafton and Wollongbar experiment farms the plants were not affected at all during the winter months.

Kikuyu Grass.

The grass possesses a strong main root system, and throws out roots at every node or joint of the stem

In one of the coldest portions of the State the grass was cut back by frost, but it lived through the winter and came away well the following spring.

As regards drought resistance, the Department of Agriculture in South Africa states that "for drought resistance kikuyu grass is great, and has no rival. When the surrounding veldt is dry and withered, the kikuyu remains green, giving one the impression of an irrigated field of forage. All kinds of stock are extremely fond of it, and prefer it to other grasses. The food value is high and superior to our other grasses."

As far as the drought-resisting qualities of this grass in New South Wales are concerned, very little data is as yet to hand; all reports from the drier portions of the State, however, are so far very favourable.

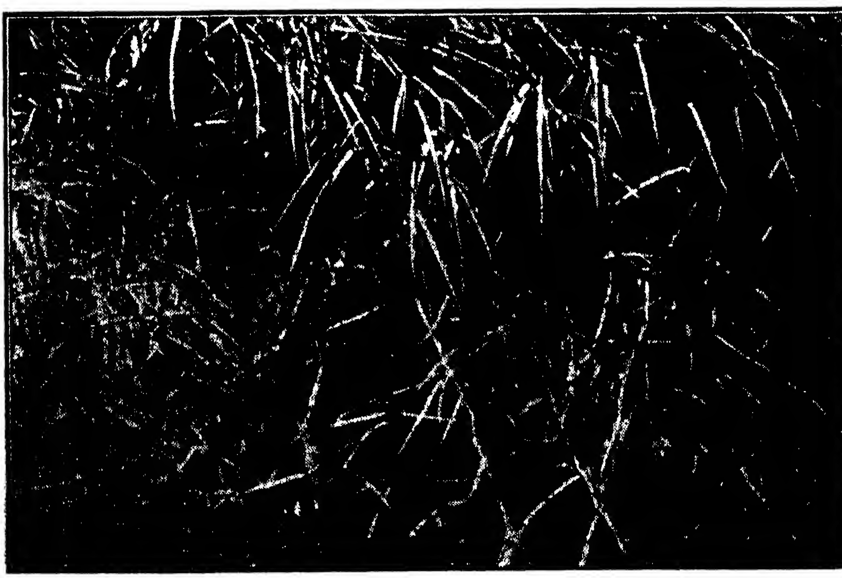
Districts where Kikuyu is being tested.

Kikuyu, being a very succulent grass, as well as a rapid grower, gives one the impression that best results will be obtained in districts possessing a good rainfall and long spring and summer growing seasons. However, rooted cuttings have been forwarded to certain districts in New South Wales where the annual rainfall is not heavy, and the results of their growth in a few years will prove whether its ability to withstand harsh conditions is as great as is stated by the South African authorities. The districts to which it has been sent are Holbrook, Culcairn, Gilgandra, Carcoar, Warren, Grenfell, Coonabarabran, Wagga, Murrumburrah, and Dubbo. Rooted cuttings have also been sent to Glen Innes, Stonehenge, Werris Creek, Tamworth, Quirindi,

Singleton, Yanco, Orange, Moss Vale, Mittagong, Unanderra, Pambula Kiama, Wollongong, Castle Hill, Woy Woy, Gosford, Tuggerah, Wyong, Wyee, Toronto, Windsor, Kurrajong, Coopernook, Grafton, Dorrigo, Kyogle, Casino, Lismore, Byron Bay, South Australia, Victoria, Queensland, Western Australia, New Zealand, and Fiji.

The Grass in America.

The Agronomist, United States Department of Agriculture, Washington, D.C., writes in *Farmers' Bulletin* No. 1125, May, 1920:—"Kikuyu grass (*Pennisetum longistylum*) has leaves and creeping stems much like those of carpet grass (*Paspalum compressum*), though much larger and more succulent. It makes a very dense growth, the first growth being erect, but when the



Kikuyu Grass produces a large amount of Fodder.

Note the strong runners in the foreground, which enable the grass to cover the ground quickly.

stems reach 15 or more inches in height they become very decumbent at the base, matting down so that the lower leaves soon die; hence it is not well suited for making hay. It bears frost about as well as carpet grass, is much more vigorous and productive, is eaten greedily by horses, cattle, and hogs, and promises to be of great value as a pasture grass."

Reports from Growers.

The Manager, Grafton Experiment Farm:—"The cuttings were planted on 31st May, 1920, on red volcanic soil. The grass responded well to Grafton conditions; herbage, soft and succulent, and leaves abundant. The plot was 1 chain long by 3 feet wide; harvested on 30th November, it yielded 121 lb. of green fodder. The average height before cutting was 2 feet. A

palatability test was conducted, the grass being cut and fed to a horse, which ate it with apparent relish. A quantity was also cut and fed to a few cows, but they did not take to it so well, possibly because of the abundance of other grasses in the paddock at the time."

Mr. W. J. Biddles, Wirrimbi, Nambucca River:—" The roots were planted on 18th May. All grew well and continued to make good headway. It promises to be a valuable grass for the North Coast, provided it has good milk-producing qualities. The growth is very vigorous, and I think it will hold its own with paspalum."

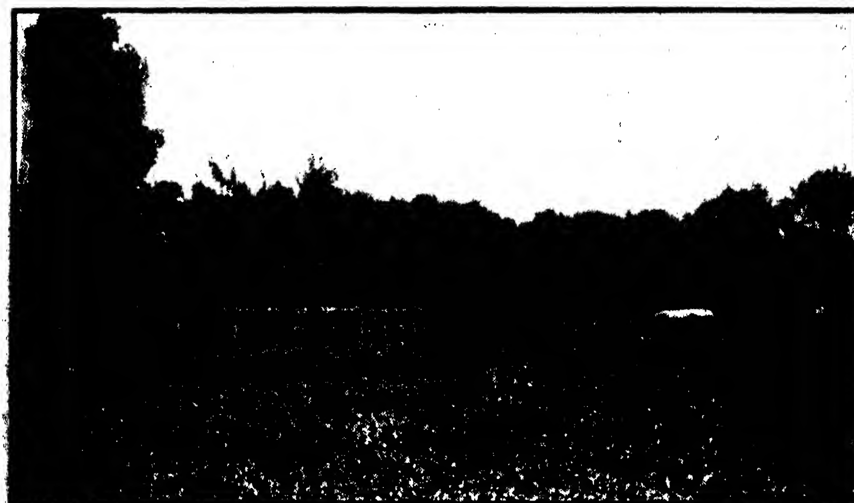
Mr. A. E. Boswell, Farm Home for Boys, Mittagong:—" The roots were planted in June, 1920, but made very little growth for the first few months, owing to unfavourable conditions. The grass is now fine and succulent, and I would say it is very suitable for this district."

The first growth of Kikuyu Grass.
The cows have just been turned in.

Mr. J. Froome, Knowle Farm, Toronto:—" The roots planted in a grazing paddock are doing well; some are on high ground and some on low. It appears to hold its own with most of our grasses, and cattle seem to eat it readily; once established it should prove a good drought resister."

Mr. Edward McGrath, Ocean View, Pambula:—" The roots were planted in August, 1920, on rich black soil; the grass made good growth, and in February, 1921, the plants had spread 8 feet from the centre, and were 3 feet 7 inches high. A few roots were planted in poor soil, and made fairly good growth, the plants being 5 feet 4 inches in length from the centre, and about 1 foot 8 inches high. This is the best grass I have ever seen, and the hot, dry weather never affected it. I would like to plant 10 acres of it, if I could obtain the material with which to do so."

Mr. A. Hull, Ooma Estate, Grenfell:—" Our patches of kikuyu are not yet sufficiently advanced to have them fed off, but I have tried the grass in two positions, one fairly dry, the other moist. That which has been watered made an abundance of top growth, but has not spread a great deal, whereas the one under dry conditions has done the reverse, as it is rapidly covering the ground. My opinion is that given a good deep soil, and being allowed to become well established, this grass will do well. When the conditions are favourable I intend to put it out in a paddock, and protect it with a rough fence until well established. I am quite certain it will do well here, given a reasonable rainfall."



First growth Kikuyu Grass half eaten down.

Mr. J. Parslow, Kelvin Grove, Collie-road, Gilgandra:—" At the time of planting (October, 1920) very hot and dry conditions were experienced, but early in November good rain fell and about 70 per cent. of the roots struck and have made good growth. The horses broke into the kikuyu patch and ate the grass readily."

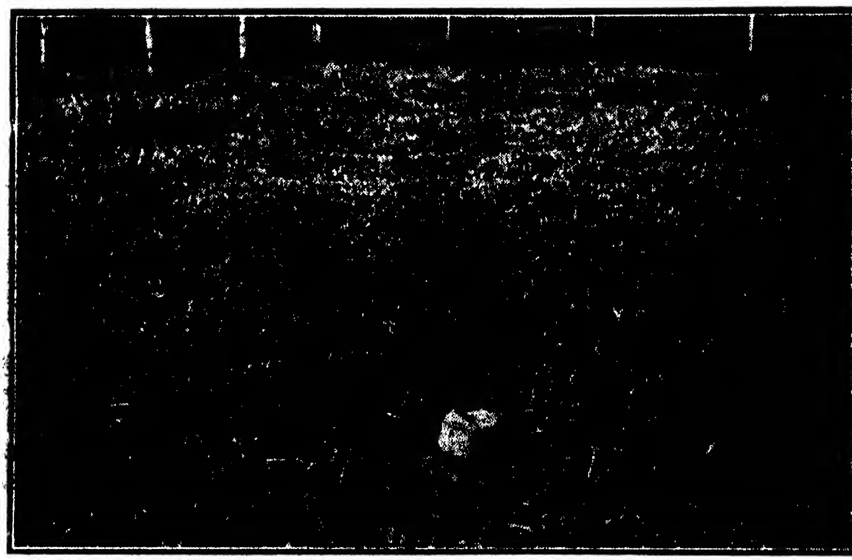
Mr. E. W. Hatton, Oolburn, Queensland:—" Both Mr. L. Hughes, of Stewart's Creek, near Townsville, and I are growing this grass, and we are of the opinion that it will prove very valuable for Queensland."

Mr. Amos Peake, Rossvale, Pittsworth, Queensland:—" The roots were planted in April, 1920. Droughty conditions prevailed at the time of planting, but the grass grew well until frosts came, after which no growth was made until the spring. Kikuyu seems to stand dry weather well, and has made great growth since spring; it promises to be an excellent one for grazing purposes."

Mr. G. L. Sutton, Department of Agriculture, Western Australia :—" The growth made from cuttings supplied in the early part of 1920 is rapidly covering the ground and looks very promising, being very healthy. This grass was planted at the Chapman Experiment Farm."

When to Plant.

Planting in the coastal districts may be carried out in the early autumn, or in the spring and summer months—for preference, the spring. In districts where severe frosts and cold conditions are experienced, spring and early, summer plantings are recommended.



The first growth eaten off.
In the foreground the second growth is just coming away.

Nature of Growth.

Kikuyu grass is a perennial, and spreads rapidly over the ground by means of running stems or stolons, which carry a large quantity of leafy material thus providing a very bulky mass of fodder. The grass grows very rapidly, and the stolons send out roots from every node or joint, thus anchoring the plant firmly in the ground, and at the same time forming a dense turf, which will stand the tramping of heavy stock well. This turf-forming habit is one of the most important factors to be considered when selecting grasses for permanent pasture. Tussocky grasses do not cover the ground well, leaving bare patches which later on become smothered with weeds. If not allowed to seed periodically, tussocky grasses become tramped and eaten out more rapidly than turf formers.

Propagation.

Propagation is effected by dividing the crowns of well-rooted plants, cutting the rooted running stolons into sections, or by making cuttings of the upright-growing stems; in each case the piece of the plant used need not exceed 6 inches in length when cut.

Preparation of the Soil and Planting.

If a large area is to be planted, the paddock should be ploughed some time previously and kept in good condition. Drills may be struck out 3 feet apart, and the cuttings set a similar distance apart in the drills; about two-thirds of the length of the cutting should be under ground, and covering may be effected by hoeing earth on to the cutting. Another method of planting, which may be adopted where land is in good condition, is to plough the field in the ordinary way, and plant the cutting in every third or fourth furrow. Where a paddock is too rough to be ploughed, the cuttings may be hoed in, care being taken to firm the soil around each piece as it is set.

Almost any Class of Soil for Kikuyu Grass.

This grass, being a gross feeder and producing a large quantity of fodder, will give the best results when planted on alluvial soil. At Hawkesbury Agricultural College, it is growing exceptionally well on sandy soil, and an area has lately been planted on a light pipe-clay loam with good results. On the sandy soil the grass is in places 3 feet high, and very bulky. It was observed, however, that a number of running stems were pulled up by the cows when grazing on the sandy area, as the soil was not compact enough and the roots not sufficiently well developed to keep the stems firmly fixed in the ground. This fact points to the advisability of allowing the grass to become well established before grazing it, or to handle the first growth when about 2 feet high for green feed, cutting it with a scythe or mowing machine.

ANALYSIS of Kikuyu.

	Green.		Air-dried.	
	New South Wales.	South Africa.	New South Wales.	South Africa.
Moisture	81·25	76·09	9·25	8·29
Ash	2·40	2·60	8·82	9·42
Ether extract ...	0·47	0·51	1·57	1·79
Crude fibre	5·98	7·91	24·25	33·08
Carbohydrates ...	5·89	9·26	43·74	35·06
Crude protein ...	4·01	3·63	12·37	12·36
	100·00	100·00	100·00	100·00
Albumenoid ratio			1 : 3·8	1 : 3·2

The New South Wales analysis was made from a two-months' growth of kikuyu produced on sandy soil; these particulars are not available about the South African sample.

Feeding-off Test.

On 21st December, an area of one-fifth of an acre was set aside for a feeding-off test at Hawkesbury Agricultural College. The area had been planted on the 30th July preceding. Two cows (a Jersey and a Red Poll) were turned in on the plot, and their milk and butter-fat records for the period the grass lasted are as follows :—

YIELDS of Two Cows grazed on Kikuyu on dates stated.

Date.	Cows Feeding.	Name of Cow—"Capture." Breed—Jersey.				Name of Cow—"Gesture 2nd." Breed—Red Poll.			
		Morning.		Evening.		Morning.		Evening.	
		Milk.	Test.	Milk.	Test.	Milk.	Test.	Milk.	Test.
		lb	%	lb.	%	lb.	%	lb.	%
20 Dec., 1920 ...	On ...	...	...	11	4·8	...	...	12½	3·8
21 ,, ,, ...	,, ...	15½	3·3	13	5·5	16	3·2	14	3·5
22 ,, ,, ...	Off ...	14	3·5	13	4·5	15½	3·4	13	3·5
23 ,, ,, ...	On ...	17½	4·3	12	4·2	20½	3·3	14	3·6
24 ,, ,, ...	,, ...	20	4·1	12½	5·3	20½	3·4	15	3·8
25 ,, ,, ...	,, ...	20½	4·0	12½	4·1	19½	3·6	14½	3·5
26 ,, ,, ...	,, ...	19	3·2	13	5·7	20	3·2	12	3·4
27 ,, ,, ...	,, ...	19	3·8	12	4·8	19½	3·4	13	3·6
28 ,, ,, ...	,, ...	18	2·6	14	6·1	19½	3·6	13½	4
29 ,, ,, ...	,, ...	18½	4·8	13	5·4	20	3·4	14	3
30 ,, ,, ...	,, ...	19	4·2	13	3·4	19½	3·6	13½	3·6
31 ,, ,, ...	,, ...	18½	3·2	12	5·5	19	2·5	14	3·8
1 Jan., 1921 ...	,, ...	18	4·4	11	4·2	19½	3·2	14	3·8
2 ,, ,, ...	,, ...	18	4·1	11½	4·4	18½	3·2	14	3·6
3 ,, ,, ...	,, ...	17	4	12	4·3	19	3·4	12½	3·7
4 ,, ,, ...	Off ...	17	3·7	11	4·3	18	3	12	3·3
5 ,, ,, ...	,, ...	16½	4	12	4·6	16	3·2	10½	3·3
6 ,, ,, ...	,, ...	17	4·8	11½	4·4	17	3·2	11	3·5
7 ,, ,, ...	,, ...	16½	3·8	12	4·7	17	3·4	12	3·2
8 ,, ,, ...	,, ...	17½	3·4	12½	4·8	17½	4	13	3·2
9 ,, ,, ...	,, ...	17	5	11½	4·2	17	3	12	3·8
10 ,, ,, ...	,, ...	17	3·3	11½	3·7	16½	3·3	12	3·8
11 ,, ,, ...	On ...	17½	4·3	12½	4·8	17½	3·5	12	3·4
12 ,, ,, ...	,, ...	18	3·9	11	3·6	14½	3·1	12	3·5
13 ,, ,, ...	,, ...	18½	3·1	12	3·8	17½	3·0	12	3·2
14 ,, ,, ...	,, ...	17	3·6	13½	4·8	16½	2·8	12½	3·5
15 ,, ,, ...	,, ...	17	4·8	11	4·2	18	3·0	12	3·4
16 ,, ,, ...	,, ...	17½	4·0	12	4·4	17	3·1	11½	4·3
17 ,, ,, ...	,, ...	17½	3·4	11	4·5	17½	2·9	12	3·7
18 ,, ,, ...	,, ...	18	4·4	11½	5·2	17	3·2	11½	3·8
19 ,, ,, ...	,, ...	17	4·4	12	4·8	17	3·2	12½	3·3
20 ,, ,, ...	Off ...	17	4·2	11	4·1	17½	3·2	11½	3·4
21 ,, ,, ...	,, ...	16	3·4	10½	4·7	18	3·0	11	4·8
22 ,, ,, ...	,, ...	17½	4·1	10½	4·3	17	3·1	11	3·3
23 ,, ,, ...	On ...	16	4·1	12	4·3	16½	3·1	11½	3·3
24 ,, ,, ...	,, ...	16½	4·0	11½	4·2	16½	2·8	11	3·6
25 ,, ,, ...	,, ...	15½	4·0	11	4·6	16	3·4	11	3·0
26 ,, ,, ...	,, ...	16½	4·3	11	4·6	18	3·0	10	3·2

For three or four weeks prior to the commencement of this test, the College pastures were in excellent condition, due to the exceptionally good rainfall and growing season.

Capture's average milk-yield for fifty-three milkings while feeding on the grass was 14·82 lb., with an average test of 4·3 per cent. Her average milk-yield for twenty-two milkings while off the grass was 14·09 lb., with an average test of 4·16 per cent.

Gesture's average milk-yield works out at 15·33 lb., with an average test of 3·37 per cent. for fifty-three milkings while on the grass, and 14·36 lb. per milking for twenty-two milkings, with an average test of 3·4 per cent., when off the grass.

One of the accompanying illustrations shows the second growth coming away readily after the feeding-off test was concluded; it gives some idea of the vigour of this grass, and also the manner in which the animals cleaned up the paddock.

Palatability Tests.

In order to obtain some data as to the palatability of kikuyu grass compared with other fodders, the following tests were carried out :—

1. Two cows were taken off the natural pasturage and turned in on the kikuyu. They ate the grass readily and fed on it for an hour; at the end of this period they stood contentedly chewing their cud. The natural pasturage was in excellent order, there being a good growth of grasses and clovers present.

2. Two cows were put in the kikuyu after they had been milked. While in the bails each cow had received the following quantity of food :—17½ lb. maize silage, 5½ lb. lucerne hay, 2 lb. bran. In addition to this they had been feeding on the natural pasturage from 8 a.m. to 3 p.m. On the kikuyu grass they repeated the performance of the above pair of cows, readily eating the material with very apparent relish.

3. To compare the palatability of kikuyu with other grasses, all the grasses were cut and placed separately in heaps in a yard, and observations as to palatability were recorded. Three lots of cows were used, and it was observed that the grasses were preferred in the order given for the various groups of cows :—

Grass.	Stage of growth when cut.	First Group. (3 cows.)	Second Group. (4 cows.)	Third Group. (6 cows.)
Hungarian brome (*Bromus inermis*) ...	In flower	1	1	1
Kikuyu (*Pennisetum longistylum*) ...	4 months' growth	2	4	3
Para (*Panicum muticum*)..	5 " ...	3	2	4
Bent grass (*Agrostis vulgaris*)	In flower	4	3	2
Coolah (*Panicum prolutum*)	Seed forming ...	7	5	5
Timothy (*Phleum pratense*)	" ...	6	6	7
Kentucky blue (*Poa pratensis*)	Green growth 12 inches high.	5	8	8
Cocksfoot (*Dactylis glomerata*)	In flower	8	9	6
Rhodes (*Chloris gayana*)	" ...	9	7	9
Hooker's Fescue (*Schedonorus Hookerianus*).	Seed forming ...	10	10	10
Brown-top (*Pollinia fulva*)	In flower	11	11	11
Deyeuxia coarctata	" ...	12	12	13
Blue grama (*Boutelo a oligostachya*) ...	" ...	13	13	12
Pennisetum massaicum	" ...	14	14	14

Experiments on a large scale are being commenced this year at the experiment farms, in order to ascertain the manner in which this grass stands heavy grazing, and to prove its milk-producing qualities.

Conclusions.

1. Kikuyu is propagated by means of cuttings, rooted runners or divisions of the crown of the plant.

2. It grows well on almost any class of soil.

3. Temperate situations with good rainfall are most suitable, as the grass thrives where the spring and summer seasons are long.

4. It stands frosts fairly well.

5. Reports from other parts of the world state that it is an excellent drought resister.

6. Spring and early summer plantings are recommended in cold districts; any time from September to March in other parts, provided the soil is moist enough to enable the plants to become well rooted.

7. It is recommended for planting in soil subject to erosion.

8. It should be useful in bracken fern country, as it would tend to smother out the fern.

9. It should be permitted to become well established before being fed off, as the cattle may tear up the runners if they are not well rooted.

10. As the plant does not form seed, it should not be difficult to keep it in check, if so desired.

To Secure Bees from a Bee Tree.

The spring or early summer is the best time to obtain bees from bee trees, as they will then have a chance to build up during the season. First prepare a box the same length and about three-quarters the width of a standard hive; this should be made so that frames will fit into it neatly, and a sliding wire cloth cover should be fitted so as to allow of ventilation. In most cases it is necessary to fell the tree. After exposing the comb and colony (preferably with the aid of a saw, mall, and wedges), carefully remove the honey and brood combs. The bees will then usually cluster. If the queen bee can be found, place her in a cage. The best pieces of brood comb should then be cut neatly to fit in a frame, and made secure with string fastened right round from the bottom bar and over the top bar. The cage with the queen is then fastened to the top of the inside of the box, and the frame of brood made secure in the box also.

The next procedure is to get as many bees in the box as possible, and then to place the box in a convenient position for the remaining bees to enter. It is generally advisable to leave the colony in this position for a few hours, so that as many flying bees may be collected as possible. The colony may then be taken home and transferred to a hive, in which the frame of brood is also placed. The queen is liberated, and a piece of queen-excluder fixed on the hive entrance, and left on for three days to prevent risk of the colony absconding.—W. A. Goodacre, Senior Apiary Inspector.

The Action of Formalin upon Seed Wheat.

G. P. DARNELL-SMITH, D.Sc., F.I.C., F.C.S., Biologist.

A VERY interesting and extensive paper has been published by Miss Annie M. Hurd in the *Journal of Agricultural Research*, Vol. XX, No. 3, p. 209, entitled "Injury to Seed Wheat resulting from Drying after Disinfection with Formaldehyde." The paper has perhaps particular interest to the present writer in that a suggestion put forward in 1912 in a joint paper with Mr. W. M. Carne is, to a great extent, confirmed. In this notice it is proposed only to call attention to the most salient points of Miss Hurd's paper. Before doing so, it may be well to outline the chemical character of formalin.

Formic aldehyde or formaldehyde is a gas. If liquefied, the liquid boils at a temperature of − 21 degrees Cent. Formaldehyde is prepared in the laboratory by passing a mixture of methyl alcohol vapour and air over red-hot plantinum wire. It is made on a large scale by a secret process, and sold in solution in water. This solution contains approximately 40 per cent. of formaldehyde, and is known as formalin. When formalin is allowed to evaporate, a new substance is formed. This is known as paraformaldehyde; it is left behind as a white solid when the solution evaporates. It has the same percentage composition as formaldehyde, but differs from it in its chemical and physical properties; it is spoken of as a polymer of formaldehyde.

In agricultural practice, formalin is used as a fungicide for wheat and other grain infected with smut. The usual recommendation has been a dip of about 10 minutes in a solution consisting of one part formalin to 320 parts water, followed by a 10 minutes drain. Almost without exception instructions are given to dry the seed thoroughly before storing it.

In Miss Hurd's paper "the major conclusion reached is that it is extremely hazardous to dry seed which has been treated with formaldehyde solution, and that, contrary to common belief, seed wheat is absolutely uninjured by a 0·1 per cent. solution (1 to 40),* and, if kept moist, may be indefinitely held unless attacked by molds."

The results obtained by several investigators are quoted, which go to show that storage after treatment with formaldehyde solution results in injury and defective germination.

"The first investigators to connect this storage injury with that property of formaldehyde by virtue of which it forms a solid condensation product or polymer upon evaporation, were Darnell-Smith and Carne,† who attributed

* One pint of standard formaldehyde solution in 40 gallons of water.

† Darnell-Smith, G. P., and Carne, W. M. The Effect of Formalin on the Germination of Plants, Third Report, Government Bureau of Microbiology (N.S.W.), 1912, pp. 178–180.

the conflicting reports of the injury resulting from the formaldehyde treatment to variations in the deposit of this polymer on the seed as it dried. They found low germination percentages and defective seedlings to result from the drying of treated seed. Their results do not agree with those of McAlpine, which were responsible for the latter's conclusion that soaking in water prior to sowing removed the cause of the injury. They did find, however, that washing immediately after treatment prevented subsequent injury in storage by removing the source of the deposit. They thought that there was no internal poisoning of the seed before germination, but that there was some deleterious chemical action of a formaldehyde salt in the pericarp, which was alleviated by soaking. Muller and Moltz* proved that the polymer, paraformaldehyde, when mixed with the soil was very injurious to wheat when sown in it."

Miss Hurd proceeded to test the effect of sowing formalin-treated seed in dry soil, a point which is of especial interest in Australia.

"After it had been determined that wheat stored and allowed to dry after treatment was seriously injured, the next question which arose was whether the same injury would be produced if seed sown immediately after treatment in dry soil remained there for some time before sufficient rain fell to dampen the soil and induce germination. In dry regions wheat often lies in the soil for weeks before germinating. To duplicate these conditions, seed was treated in the usual manner with 0·1 per cent. solution of formaldehyde and sown, 50 seeds in a pot, in air-dry soil. One pot of each, with a control of seed treated similarly with water, was watered after pre-determined intervals such that the first pot was watered, and started to germinate, immediately after planting, while the last one remained dry for a month."

The results of the experiment are given in the following table :—

Percentage of Germination of Little Club wheat after lying in dry soil (Yolo clay loam) following treatment with 0·1 per cent. Formaldehyde Solution.

Treatment.	Water applied after—								
	0 Days.	1 Day.	2 Days.	3 Days.	4 Days.	5 Days.	7 Days.	10 Days.	14 Days.
Treated	98	94	94	86	94	64	52	52	42
Controls, soaked in water	100	98	100	98	98	98	98	98	100

"The data indicate that it is not safe to treat wheat with formaldehyde, even when the strength of solution is as weak as 0·1 per cent, if the seed must be sown in very dry soil without certainty of rain within a few days. The injury from drying, either in storage or in the soil, is greater the more concentrated the solution used."

* Muller, H. C., and Motz, E., 1914. Versuche zur bekämpfung des steinbrandes bei dem winterweizen mittels des formaldehyd-verfahrens. Fühlings Landw. Ztg. Jahrg. 63, Heft 23, pp. 742-752.

An interesting confirmation of the fact that solutions of formaldehyde grow stronger as evaporation proceeds is given. It is well to emphasise this, for there is a popular notion that formaldehyde escapes from solution and that in consequence the solution becomes weaker.

"It has been shown* that dilute formaldehyde solutions grow stronger as evaporation proceeds. Notwithstanding this fact, published statements to the contrary occur in literature relating to the use of formaldehyde as a fungicide. The weakest solution analysed by the writer was a 0·113 per cent. dilution. It was found by quantitative analysis of solutions before and after evaporation that the amount of formaldehyde per cubic centimeter of solution steadily increased as evaporation proceeded."

It was shown that the solid paraformaldehyde gradually became gaseous.

"By successive weighings it was found that paraformaldehyde is volatile, gradually breaking down and escaping as formaldehyde gas. To this property we may safely look for a large part of the seed injury following treatment with formaldehyde."

Further experiments showed that the cause of injury to treated seeds upon drying was the production of an atmosphere of concentrated gas adjacent to the seed as a result of the constant evaporation of a coating of paraformaldehyde.

"The significance . . . . for the problem of post-treatment injury of dried seeds is that when there is no aeration the formaldehyde gas from the evaporating paraformaldehyde on the seeds easily saturates the atmosphere in the interstices of the sample and inhibits the evaporation of more of the solid. The slower the outward diffusion of the gas the longer will the paraformaldehyde remain on the seed surfaces and the longer will a toxic atmosphere exist about them. As the penetration of the seed coat and subsequent injury by formaldehyde is comparatively slow, usually occurring in from three to five days with a 0·1 per cent. solution, it is entirely conceivable that with rapid drying and thinly-spread seed any paraformaldehyde formed can be completely evaporated and its dissipation effected so rapidly that it cannot enter and injure the embryo."

The conclusion finally reached is that "the degree of post-treatment injury depends primarily on atmospheric humidity during the storage period. In atmospheres damper than 70 per cent. humidity the treated seed can be kept indefinitely without ill effects. In those of 70 per cent. and less there is decided injury, which is most severe in the intermediate humidities, gradually decreasing in the lower ones until seed stored in an absolutely dry chamber is almost uninjured."

* Ladd, E. F., 1904. Analysis of formaldehydes sold in North Dakota. N. Dak. Agr. Expt. Sta. 15th Ann. Rpt. (1904), 105, Pt. 1, pp. 18-30, and Shutt, F. T., 1908, Report of the Chemist. Insecticides and Fungicides. Canada Expt. Farms Rpts. (1907), 108, pp. 165-173.

The Larkspurs as Poisonous Plants.

Miss Hoffmann, a resident in the Trangie district, sent in November some larkspurs, with the statement that they are very poisonous, "as flies, butterflies, moths, bees, caterpillars, and other insects are all dead under them, as if they have just fallen as soon as they alight on the plant." The plants sent were a pink one—one of the Imperialis varieties of *Delphinium consolida*—and the common blue larkspur, *D. Ajacis*.

In reply to my request for further information, the lady writes, under date 2nd December, and she is still observing :—

I have taken particular notice that the pink larkspur seems the more deadly of the two, as it is under that one that practically all the insects are dead. The blue one seems poisonous enough, but not nearly as bad as the pink one. And then again it seems that there are times when it does not kill them at all. This last couple of weeks—in fact a month—I have noticed that it has not been killing them at all. Some time ago the very same thing happened, and then one morning when I went out there were all sorts of insects dead underneath the pink one.

I think myself that it is when the plant is young that it is the most poisonous, and it is not the flower that does it, as this happened before it started to flower, and also afterwards. Whether it is because the insects do not alight on it so much at times, or whether it is that it loses its poison as it gets older, I could not say, but to my thinking (just what I have noticed about it) I fancy it is the younger plants that do the most harm.

In this *Gazette* (Vol. XI, p. 181, 1900) Mr. W. W. Froggatt, Government Entomologist states that the common garden larkspur will kill locusts (*e.g.*, Bath, speaking of Victorian locusts in 1874, and Condobolin in 1899), and advises that they be planted in masses around gardens and orchards to protect against the ravages of these insects. Mr. J. F. Bailey in Queensland *Agricultural Journal* for March, 1899, p. 200, says that these plants have been poisonous to grasshoppers in South Australia. Very few observations have been made in regard to these plants in Australia, and Bulletin No. III, Part 1, of the U.S. Department of Agriculture, "The Larkspurs as Poisonous Plants" (Albert C. Crawford, 1907) is worthy of attention, especially as in various parts of the world they have escaped from gardens and become a pest to the farmer to a small extent.

In Canada and the Western United States they (there are several species) have often been accused of sheep poisoning. It is stated as regards some experiments by Dr. Crawford in Colorado, that "this larkspur (species not quoted) is most virulent in its early stages and becomes much less active toward flowering time." The observations of Miss Hoffmann bear out this. It is stated that larkspurs have also killed cattle.

The cultivation of these beautiful flowers (which have been much improved of late years) is on the increase with us, and we are a sheep-raising country. There is a good deal of contradictory evidence in regard to the toxicity or otherwise of certain species of larkspur, and enough has been said to show the necessity for clearing up all doubts so far as Australia is concerned. I therefore invite correspondents to contribute any observations as to what extent larkspurs are poisonous to insects, sheep, and any other animals. If a specimen of the larkspur be sent to me, I will say what kind of larkspur it is, and also pass on the evidence as to poisoning (or the reverse) to the Chief Inspector of Stock.—J. H. Maiden.

Staggers or Shivers in Live Stock.

SYDNEY DODD, D.V.Sc., F.R.C.V.S., University of Sydney, and MAX HENRY, M.R.C.V.S., B V.Sc., Department of Agriculture.

For many years past a condition known as "staggers" or "shivers" has caused considerable economic loss to owners of live stock in certain areas in the basin of the Namoi and its tributaries, and also on the Gwydir. As far back as 1895, Mr. E. Stanley, F.R.C.V.S., reported on a condition known as "shivers" in the Hunter River valley, and in 1900 Mr. J. D. Stewart, M.R.C.V.S., on a similar condition, locally referred to as "staggers," in sheep on the Namoi. Since then the condition has been the subject of observation, and information has been collected as opportunity occurred by the veterinary officers attached to the Stock Branch and by the authors of this note; but for a number of reasons it was not until last year that definite experimental work that would be of scientific value, whether successful or unsuccessful, could be undertaken. The investigations, which were carried out at Tamworth, Carroll, and Moree, and at the Veterinary School of the University, have considerably increased our knowledge of the complaint, and it is desired here briefly to place the results obtained on record, while full details of the various experiments are being compiled for later publication.

Animals Affected.

All classes of live stock appear to be affected. Cases have been observed in sheep and horses, and reported in cattle. It is far more common in sheep, but this is probably due to their great preponderance in numbers. In sheep the condition is seen both in Merinos and crossbreds, although local opinion holds that the Merino is more resistant. Experimentally, however, all are equally susceptible. Sex and age have no influence in the occurrence of the disease. Very young lambs a few days old and aged sheep become affected naturally and experimentally. Condition makes very little difference, although it is widely held that fat animals most readily become affected. This opinion is probably due to the fact that animals are naturally fatter when the causes of the trouble are most abundant, viz., in good seasons.

Incidence of the Disease.

The condition is most noticeable in the spring and early summer, especially if during the previous winter good rains have fallen, with a corresponding growth of herbage.

Staggers is seen on river flats that grow a luxuriant crop of herbage, chiefly consisting of trefoil, mallow, crowfoot, shepherd's purse, &c., in the spring. The condition has not been observed in stabled animals.

Symptoms.

As mentioned, cases in sheep are the most numerous, other animals as a rule being affected in isolated instances, and the following condensed account of the symptoms consequently relates mainly to those observed in sheep.

As a rule animals do not show any symptoms while feeding quietly in the paddocks, although individual cases have been noticed where signs of staggers have appeared immediately the animal has moved. If, however, a mob of affected sheep are started on the road at the usual pace, they may travel a few hundred yards or a few miles, according to the severity of the affection, and then sick animals will begin to lag behind. These move with a rather stiff action of the hind legs, heads pushed out in front, and backs hunched. They travel for a little distance, the symptoms becoming more pronounced, and then come to a standstill, the breathing being very rapid but shallow. If compelled to move, they will travel a few yards and then stop again, showing a peculiar shivering or trembling of various parts of the body, mainly in the regions of the fore and hind quarters, but in bad cases extending all over the body. At times the animal will collapse, lying down, usually with outstretched head. If allowed to rest for a while, the affected animal will rise and go cn for a while, only in most cases to be again attacked by the same train of symptoms. If the animal is continually urged forward it will in most cases die.

Post-mortem Appearances.

There are practically no changes to be observed with the naked eye when the carcase is opened, and without previous information it is impossible to say that such an animal has or has not been affected with any abnormal condition. Such animals are commonly killed and eaten as food without any injurious result, and the condition does not affect the marketability of the meat in any way.

Causes of Staggers.

Many theories have been advanced as to the cause of this complaint, but the researches of the past year have definitely established that it is of dietetic origin, and not contagious or due to bacteria or other organisms. So far as has been seen, it cannot be transmitted by inoculation from an infected to a healthy animal. It has been suspected for some time by a number of people that the mallow had some connection with the occurrence of the complaint, but no work had been done to confirm or dispel such suspicion. The experimental investigations carried out by the authors both in the field and at the University have proved conclusively that two plants at least are able to convey the condition known as "staggers" to sheep. These are the common mallow (***Malva parviflora***) and a plant closely allied to that, known as stagger weed, viz., ***Lamium amplexicaule***. It is quite possible that other plants may also be able to induce the condition, but so far there is no experimental evidence to incriminate any save the two mentioned. The plant commonly known as stagger weed or hedge nettle (***Stachys arvensis***) is very widely held to be responsible for producing staggers or shivers, and it is a question whether the corruption of the botanical name ***Stachys*** into

"staggers" in popular language is responsible for the view that stagger weed causes staggers, or whether there is actual foundation for that opinion. It has to be borne in mind in connection with this that *Stachys arvensis* has been experimentally fed to animals at different times by a number of workers, and no one has apparently succeeded in producing staggers with it.

In the experiments referred to, a condition exactly similar to that seen under natural circumstances has been produced in sheep by feeding mallow from the affected localities, the work being carried out both in such areas and in places where it does not naturally occur (as, for example, the University). In so short a time as seventy-two hours after placing them on a mallow diet, the disease has made its appearance in lambs. The plant will produce the disease in the young, green, and shooting stage, when well grown, and when dying off. Feeding with seeds alone has also induced symptoms.

Experiments to show whether mallow from other parts of the State than those enumerated will produce staggers are not conclusive, but the suggestion that it is able to do so is very strong.

In the experiments both adult sheep and lambs, male and female, crossbreds and Merinos, have been successfully affected.

Lamium amplexicaule (there is no popular name for this plant) will, when well grown, produce staggers in sheep and lambs almost as rapidly as mallow, but whether it is capable of doing so in all stages of its growth is not yet known. Feed such as trefoil, lucerne, crowsfoot, &c., although grown in the same paddock, have been proved not to produce staggers.

Course and Termination of the Disease.

So long as animals remain on the mallow or lamium feed, the condition continues; but if removed and placed on other feed, even in an affected locality, recovery is rapid. There is some evidence that the rapidity of this recovery varies directly with the length of time that the animal has been affected. When recovery takes place it is complete, and no ill-effects whatever can be seen to remain.

Many points in this obscure, but interesting, complaint remain to be elucidated, mainly of a scientific character, but the principal facts concerning its causation are now known. Plans are under way to work out some of the points indicated this year.

The work at Carroll was carried out by Mr. Hindmarsh, M.R.C.V.S., B.V.Sc., D.V.H., of the Stock Branch, and the authors are also indebted for supply of material and other assistance to Messrs. Woollett and Copeland, Inspectors of Stock, to Messrs. Smith and Prior, and Chaffey Brothers, of Tamworth.

Sawdust has little or no direct manurial value—its chief value lies in the production of a mulch which prevents undue surface evaporation. In the orchard it should be dug in lightly around the trees. It may also be used as an absorbent for liquid manure, urine, &c. If sawdust is placed in too thick a layer or heap it will be destructive to vegetation.—F. B. Guthrie.

The Introduction of Parasitic and Predaceous Insects.

The judicious introduction of parasitic and predaceous insects has sometimes proved of considerable value in checking or controlling insect pests. For instance, a minute insect parasite of the eggs of the sugar cane leaf hopper was successfully introduced into Hawaii; and *Novius cardinalis* (a scale-eating ladybird beetle) was successfully introduced into California to control cottony cushion scale on citrus trees, &c.

Discretion is needed, however, to ensure that a species is not introduced that will prove a pest instead of a friend. This danger is more apparent when leaf-eating insects are to be introduced, as they might easily in their new home turn their attention to other food plants, including cultivated trees and crops.

When it was proposed in August, 1918, that a chrysomelid leaf-eating beetle should be introduced from England to feed on and check the weed St. John's wort in this State, Mr. W. W. Froggatt, Government Entomologist, expressed definitely his fears about such a step unless adequate inquiry and tests were made before the introduction actually took place.

As a result of the Entomologist's action, the Institute of Science and Industry addressed inquiries to the Imperial Bureau of Entomology in England, and that body caused investigations to be made of the possible value or menace of such few insects as were known in England to attack St. John's wort, before further action was taken in the matter.

The report of the Imperial Bureau has now been received by the Institute of Science and Industry, by which body it has been forwarded to the Department. The report states that the researches carried out by Mr. A. H. Hamm, of Oxford University Museum, had not revealed the existence of any insect that was likely to be of practical importance. The only species that appeared to do any serious harm to the St. John's wort weed was the phytophagous beetle *Chrysomela varians*, but the sub-committee of the Imperial Bureau appointed to report on the matter decided that it would be a very dangerous experiment to introduce an insect of this kind into Australia.

The report thus justifies the hesitation that was felt here on the subject, and confirms the impression that, while the introduction of insects with such objects may at times be desirable and successful, it is a method of control that must be adopted only after careful investigation.

Cow-testing in Canada.

According to the *Agricultural Gazette of Canada* a month's campaign in favour of individual testing of cows was organised in the province of Quebec last year, all inspectors of butter and cheese factories and all county agronomists (agricultural representatives) taking part. The seed scattered by these officials fell upon good soil, and over 30,000 cows were entered by the more progressive farmers of the province. The entry was so great, in fact, that the supply of bottles, acid, and scales was quite insufficient, and many owners were unable to get the apparatus with which to test their cows. Ample plant has been ensured for the next testing period; but, even as it was, 16,000 dairy cows were actually under test in the province in 1920. Individual testing is the only way to get rid of the boarders—the cows that eat up the profits of the herd.

Tick Paralysis.

[Continued from page 272.]

SYDNEY DODD, D.V.Sc., F.R.C.V.S., Lecturer in Veterinary Pathology and Bacteriology, University of Sydney.

EXPERIMENT NO. 1.

ON 26th November, 1919, one unengorged female "scrub" tick (obtained by the method described) was placed on the dorso-scapular region of a guinea-pig, weight 820 grams.

The tick attached itself to the spot whereon it was placed in a few minutes. It did not attempt to wander to any other position before biting.

Fifth day.—Engorgement was gradual, but on this day the tick had rapidly increased to about twice the size it was overnight. The animal had hitherto shown no signs that it felt the presence of the tick, but at 9 a.m. on this day the guinea-pig, which normally was very lively and difficult to catch, appeared very quiet, and made no attempt to escape when approached. When urged to move, some slight weakness in the lumbar region was evinced. The animal was unable to run, but moved slowly, with a slight dragging motion of the hind extremities. There was no mental impairment and no pain; respirations normal; appetite lost.

At noon the hind limbs were quite paralysed. By 4 p.m. the symptoms were much more pronounced. The animal was quite unable to support itself on its legs, the paralysis having extended to the fore extremities. If the hind legs were stretched out behind, the animal made no attempt to regain the normal; but it violently resisted attempts to turn it over on its sides or back. The paralysis appeared to be entirely a motor one, the sensory apparatus being unaffected. At times there was a peculiar stertorous noise made during respiration.

Sixth day.—The animal was found dead at 9 a.m. The body was cold, but rigor mortis was absent. The tick was still adherent and almost fully engorged.

Autopsy.—Copious mucous discharge from the nostrils. The subcutaneous tissue for about an inch around the point of attachment of the tick was intensely hæmorrhagic. There was no general congestion of the subcutaneous vessels. The urinary bladder was greatly distended, with a turbid, milky-looking urine. No acetone was present. Both apices of the lungs were intensely congested. There were no hæmorrhages or œdema of these organs. The coronary vessels were engorged. No other lesions which might be attributed to the effects of the tick were detected.

A portion of the animal's skin with the tick attached to it was removed. On the eighth day (two days after the death of its host) the tick detached itself voluntarily, but it was not fully engorged. Endeavours were made to

get it to bite a fresh guinea-pig, but were unsuccessful. It became very active when placed on the animal, but refused to bite. It was subsequently preserved for the determination of its species.

Smears from blood and other fluids and organs were made, but no organisms were detected. The blood itself appeared normal. Cultural experiments were also negative.

Inoculation Experiment.—An adult guinea-pig was injected intraperitoneally with 1 c.c. of heart blood from the above animal, but the result was negative.

EXPERIMENT No. 2.

On 2nd December, 1919, one unengorged adult female "scrub" tick was placed on the right dorso-scapular region of an almost full-grown Pommeranian dog, No. 20. The tick had been obtained in the manner already described, sixteen hours previously.

The tick made no attempt to wander from the part on which it was placed, but attached itself almost at once.

First day.—There was no change in the size of the tick, but its rostrum was buried very deeply and the skin immediately surrounding the parasite was slightly swollen. There was no irritation of the part.

No change was observed in the dog during the second to sixth days inclusive (the animal normally being very vivacious), except that on the latter day it did not seem quite so hungry as usual, part of its meals (consisting in the morning and evening of raw meat) being left; up to this period the tick gradually increased in size, but there was no indication of it producing any local irritation.

Seventh day.—The animal vomited, or attempted to vomit, at intervals throughout the day. At first the vomit consisted mainly of ingested food material, but later only a frothy, yellow mucoid material was brought up. Appetite was not entirely absent, as the dog ate some of its food in the morning and evening.

During the day the animal was continually stretching and yawning. The pulse and respirations were normal. Temperature 101·4 deg. Fah. In the afternoon an almost imperceptible inco-ordination of the muscles of the hind-quarters was observed. The posterior portion of the body slightly swayed to one side as the animal walked. Such reflexes as can be obtained in the dog did not appear to be altered. The animal, which formerly was very lively, was now showing pronounced depression, taking very little notice of one on entering the cage, or even handling it.

Eighth day.—Dog seriously ill. Temperature, 100 deg. Fah. No food or drink had been taken for twenty-four hours. There were continual attempts at vomition, but only a clear, mucoid fluid was brought up. The respirations were normal in number, but were rather deep, and the animal maintained its mouth open as if from air hunger. It groaned frequently, but no definite evidence of pain could be noted anywhere. Mental faculties were not greatly impaired. The cutaneous reflexes over the whole of the body were lost. The hind-quarters were completely paralysed. The fore-quarters were

normal. The animal maintained a sitting position, but the hind-quarters were so twisted that the body rested upon the anterior part of the pelvis (ilium) instead of the posterior part (ischium), the hind limbs remaining limp. The tail, normally curled up, was now held out horizontally. Violent struggles were made, however, to resist the rectal temperature being taken.

At noon the condition was distinctly worse. The paralysis now involved the loins. The animal groaned with each respiration, and had become more indifferent to attention. Temperature, 100·4 deg. Fah.

At 4 p.m. the paralysis was steadily extending in the forward direction, the right fore-leg being now quite useless; but, strange to say, the hind-quarters had now regained a little motor power and the tail had regained its natural curl. There was, however, no ability to sustain weight, and if lifted up, the animal immediately collapsed on support being removed. While being held in the normal standing position, pronounced dyspnœa was manifested.

Seventh day.—The tick was almost visibly increasing in size, and on the eighth day it was apparently half engorged.

Ninth day.—At 9 a.m. the dog was quite comatose. Temperature, 99 deg. Fah., pulse rather firm and regular; respirations shallow, spasmodic and irregular; mouth wide open; tongue paralysed, protruded and cold; all the limbs flaccid; eyes closed.

The animal quietly died at 11 a.m. No change was observed since 9 a.m.

Post mortem examination was made immediately.

Autopsy.—The tick was not fully engorged, and only about half the size of that on the guinea-pig when the latter died. A portion of the skin, about an inch in diameter, with the tick attached to it, was removed and placed in a petri dish. The tick detached itself voluntarily on the following day, and was preserved for identification.

Rigor mortis was absent. There was no subcutaneous hæmorrhage at the site of attachment of the tick. Both cardiac lobes of the lungs were deeply congested. There were a few discrete areas of congestion about a quarter of an inch in diameter scattered about the other lobes. The urinary bladder was distended with an intensely acid, deep-yellow urine. No acetone was detected. No other abdominal or thoracic changes were observed. There was an abnormal quantity of cerebro-spinal fluid present. It was clear and colourless; no undue congestion of the cerebral vessels. Blood smears from various parts of the body, and smears from organs, fluids, brain, and spinal cord revealed nothing abnormal. Cultures were also negative.

Inoculation Experiments.—Dog No. 21, an adult fox terrier, was inoculated intraperitoneally with 5 c.c. heart blood taken from dog No. 20 soon after death. The result was negative.

Guinea-pig No. 151 was inoculated intraperitoneally with 2 c.c. cerebro-spinal fluid from dog No. 20. Result negative.

Experiment No. 3.

On 16th January, 1920, an adult unengorged female "scrub" tick, obtained in the manner described, was placed on the back of a lamb, the wool

having been previously shorn off. It remained there for about an hour, but although very active, wandering about the shorn area, it made no attempt to bite. It was then removed and placed on the back of dog No. 22, an adult fox terrier, in the region of the croup. It was again very active, and wandered about, but without any apparent sense of direction, finally reaching the left upper eyelid near the palpebral edge, where it attached itself about five minutes after being placed on its host. The latter showed no evidence that it knew of the tick's presence while the latter was biting. (Three other adult unengorged ticks were obtained from the same collector dog at the same time as the foregoing before they had attached themselves and without apparent injury; but they were dead on arrival at the laboratory about eighteen hours later.)

On the third day, the eye over which the tick was attached was moderately suffused, and there was a slight purulent discharge from the inner canthus. The upper eyelid was a little swollen. The tick could be seen only with difficulty, as it approximated in colour that of its surroundings. It would have been readily overlooked on a casual examination.

Sixth day.—The dog was as lively as ever. It had not shown any evidence that the parasite had exerted any irritative action. Temperature, 101·2 deg. Fah. The eye, save for a very slight purulent discharge, was normal. On this day, however, the animal refused its morning meal, a thing that the attendant stated had not happened before. During the previous twenty-four hours the tick had rapidly engorged itself, and on this evening it was quite twice as large as on the previous day. It was now readily distinguishable on account of its size, and its weight dragged down the eyelid to which it was attached. The dog, however, appeared to be quite unconscious of its presence.

Seventh day.—The tick dropped off during the night. Unfortunately, owing to the carelessness of the attendant, it was swept up early in the morning and lost. The dog remained quite normal in all respects, save that there was a very hard nodular swelling about the size of a garden pea at the spot where the tick had been attached.

On 19th January, 1920, an unengorged female adult "scrub" tick (obtained in the described manner) was placed on the shaved back of a sheep, where it was allowed to remain for about an hour. Although it wandered about in various directions, it did not bite. It was then placed on the back of a dog for about the same period. Here also it refused to bite.

The tick died on the following day.

The ticks causing the death of the guinea-pig and of dog No. 20 were handed over to Mr. L. Harrison for identification. He reported that they were *Ixodes holocyclus.* A number of unengorged female and male ticks removed by the writer from the collector dog, but which died before they could be applied to an experimental animal, were all identified by Mr. Harrison as being of the same species.

Remarks.

The experiments confirm what has been popular knowledge for many years, viz., that one of the so-called "scrub" ticks is capable of producing a very fatal affection in animals, the main feature of which is a progressive motor paralysis.

The identity of the particular species of tick responsible for this condition in Australia, which previously had been only surmised, and not based on experimental data, or on even the examination of the tick found on an animal suffering from tick paralysis, has now been established, viz., *Ixodes holocyclus.*

It has been shown that one tick is quite sufficient to set up the train of symptoms of intoxication and even death. This confirms the widespread view popularly held.

There is a definite period of incubation of five to six days—if the expression "period of incubation" can be used in this connection. Bancroft gives the period elapsing between the attachment of the tick and the appearance of symptoms as two or three days. The difference between the two periods may be explained by the fact that in the experimental cases the exact time of attachment was definitely known, whereas Bancroft's cases were clinical. Consequently the period given by him would probably be estimated from the time at which symptoms had first been observed, the mind going back from that period to some supposed occasion whereon the dog might have been infested. There is nothing in Bancroft's narrative to indicate that any tick which had produced the paralysis had been seen to bite. The experiments further show that what has already been mentioned to be the popular view, viz., that symptoms of paralysis appear in a day or so after infestation, is incorrect.

The symptoms were those of a motor paralysis, the sensory apparatus apparently being unaffected. The syndrome would indicate that the higher centres of the nervous system were affected, particularly the medulla. This would account for the vomiting, yawning, and stretching in the early, and the respiratory symptoms in the terminal stages of the affection. The motor disturbance, too, would appear to be located centrally rather than peripherally, the immediate cause of death being paralysis of the respiratory centre.

In the case of experiment No. 3 (Dog No. 22) no entirely satisfactory conclusion can be drawn, as one or several undetermined factors may have been concerned, viz., (1) the tick may not have been virulent; (2) the animal, which was an adult ordinary stray street dog, might have been immune through (*a*) age, or (*b*) prior intoxication. Seeing that no causal factor has been detected in the disease, the difficulty of eliminating these points is evident.

That some very slight but definite reaction did take place at the usual period, viz., the sixth day, is shown by the refusal to take food on that day. This cannot be regarded as a mere coincidence, as the animal had been under observation for some weeks before the tick was placed upon it.

At one time, from clinical evidence in naturally occurring cases, I thought the condition might be an acidosis, but examination of the urine of the experimental animals appears to negative that view.

The question as to whether the condition is due to a living organism or virus, or to a toxin or venom (the latter expression appears to me to be the more suitable one for the causal factor in tick paralysis in the present state of our knowledge, as it would then be grouped with those substances elaborated by snakes, spiders, scorpions, &c., rather than with those produced by bacteria or protozoa), is not a simple one.

In the first place, a definite period elapses between the attachment of the tick and the appearance of symptoms, but in this case the term "period of incubation" may not be synonymous. Secondly, there is the pronounced difference between the action of the venom on domesticated and indigenous fauna, it being a matter of doubt whether it has any action on the latter at all. Furthermore, even in highly susceptible domesticated animals, recovery from an attack leaves the animal with a very strong immunity (observations on naturally occurring cases), and in the latter animals immunity appears to occur with old age, independently of prior intoxication.

Opposed to the view that the cause of the condition may be a living organism, is the fact that no organism, protozoal, or bacterial, has been demonstrated in the blood or other body fluids or organs of naturally and experimentally affected animals. There is no febrile reaction, or pronounced histological change. Furthermore, attempts to transmit the disease by inoculation of blood or cerebro-spinal fluid have failed. The remaining hypothesis that occurs to my mind, which might be considered in favour of the living entity, is that the cause may be a living ultra-visible virus, but one which at the same time is non-transmissible by artificial inoculation and requires to be passed through an intermediate host, viz., the tick, before the ultimate host can be infected. So far, however, there seems to be nothing to justify such a hypothesis.

If there is no proof that the cause is a living organism, then one has to fall back on the hypothesis that it is a poison elaborated by the tick itself. In commenting on a similar condition in America, due to *Dermacentor venustus*, Nuttall and Hadwen consider that the condition described by them is due to a toxin manufactured by the tick, and explain the apparent period of incubation by considering that the toxin is not injected into the host until the period of rapid engorgement has been reached. This may be the correct explanation as regards *Ixodes holocyclus* also, but before finally accepting such a view, further research work is necessary.

Looking at the matter from a biological point of view, it certainly does not appear to be to the interest of the tick itself, as regards the propagation of its species, to kill its host before the tick can have arrived at full maturity, as exemplified in the experimental cases. One has to take into account the fact that five or six days elapse before such poison produces any observable effects, and then its action is rapid, the animal dying at times before the tick can reach maturity. Furthermore, not all ticks of this

species are virulent, as I have seen almost mature ticks on young dogs and cats under circumstances where prior intoxication could not have occurred without its being known to the owner, and no harmful results have ensued.

The fact that if ticks be removed before symptoms set in, although they may have been attached for a day or two, no paralysis results, can be used as an argument in favour of both hypotheses, viz., (1) living virus and (2) venom.

There are also the apparent facts (1) that indigenous animals are naturally immune, although, as stated, there is no experimental proof of this, (2) that all domesticated animals, although very susceptible when young, acquire considerable immunity as age progresses, independently of prior intoxication, and (3) that recovery from an attack of tick paralysis results in a powerful and lasting immunity.' Such immunity is, however, not always absolute, as I have seen two mild cases in dogs that had suffered from previous attacks.

No attempt has been made in this communication to describe the offending tick, *Ixodes holocyclus*. Such description can be found elsewhere. The life history of this ixode still requires working out, especially as the common hosts of the larval and nymphal stages are apparently not the domesticated animals.

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A Recipe for Wine-making—and a Warning.

Requests for recipes for making wines in small quantities for home consumption so frequently reach the Department that it is well perhaps to warn people that the manufacture of wine under such circumstances is by no means so easy or satisfactory as is commonly imagined. To make wine successfully and without undue risk of the whole lot going wrong necessitates considerable knowledge, practical experience, and plant, so that temperature, fermentation, and maturing can be properly controlled. Hence the Department would not encourage anyone without previous experience or with insufficient plant to attempt to make wine. The following recipe, however, may be of use for the manufacture of red wine in a small way:—

Separate the stalks from the berries and crush the berries thoroughly. Place berries and juice in a clean wooden vessel (a cask with the head out), and allow to ferment, keeping the skins immersed from time to time to avoid acetic fermentation setting in. To make a quality wine, rack or draw off liquid from skins at the period just after it has reached full fermentation; that is, just as it is subsiding from a very frothy head. Allow the liquid to ferment out, and when fermentation is complete mature in a cask, paying particular attention to keeping the cask full (free from ullage), filling up from time to time as evaporation takes place; for the purpose the wine on hand from previous vintages may be put into bottles and used for filling up. Bung up the cask well, puttying around the bung a mixture made by mixing whiting with melted fat. The object of this is to exclude the air and to minimise evaporation, and to prevent acetic germs taking a footing. Rack by syphoning the wine off the lees during the months of June and September.

After maturing for two to three years under careful supervision, the wine should be quite fit for consumption. If the wine does not clear very well, take the whites of, say, six eggs to 60 gallons, beat up well and mix into a gallon or so of wine, pouring the mixture into bulk wine, stirring thoroughly for ten minutes. In about a fortnight's time, rack off from lees, as the lees formed by the addition of the whites of eggs will be very injurious to the wine.—H. L. Manuel, Viticultural Expert.

Fumigation of Citrus Plants.

The important factors long known to modify damage to the fruit and foliage of citrus trees under fumigation with hydrocyanic acid include temperature, moisture, light, and physiological condition of the plant.

These factors have lately been the subject of experiment by the United States Department of Agriculture, and Bulletin No. 907, by R. S. Woglum, details the results. These show that fumigation is most safely performed at temperatures below 80 degrees Fah.; but under darkness or diffused light temperatures up to at least 100 degrees Fah. do not appear to increase injury unless the temperature before or after fumigation exceeds 80 degrees Fah. No trials were conducted at temperatures less than 50 degrees Fah. Sunshine is most destructive to plants exposed to it immediately after fumigation, and it affects them deleteriously at least two hours after treatment. Diffused light before, during, or after fumigation exerts no more deleterious influence than darkness. Trees in a wet soil tend to suffer more than healthy trees in a dry soil. Irrigation should follow fumigation, not precede it.

The Pruning of the Vine.

[Concluded from page 126.]

H. E. LAFFER.

Training the Vine in the Home Garden.

In the average suburban garden of the cities and towns of Australia the grape vine is popular, but only in a few instances do we find the most made of the plant, by reason of the lack of system in training. In the majority of cases the vines are allowed to ramble at their own sweet will over some supporting structure which is dignified by the name of "trellis."

As a shade plant, the grape vine has few equals, providing cool arbours in the summer when protection from the sun is most desirable. At the same time it has the advantage of being deciduous, losing its leaves in the winter, when air and light are appreciated. The return in fruit from a few well chosen and well cared-for grape vines is remarkable, and should prove sufficient for any average household. The common mistake made is in planting a large number of vines which are often more or less neglected, or are trained in such a manner that the fruit is inferior. Moreover, a few good vines are more easily cared for and protected from disease.

The varieties should be adapted to the conditions of climate under which they are to grow. For instance, varieties adapted to this State's coastal conditions are few in number compared with those suited to the less humid climates of the south and west. The grape which stands easily first in favour in and around Sydney is the Black Muscatel (Muscat Hamburg). In quality and fruit-bearing it has no peer. As the next choice, Black Hamburg may be taken, but beyond these two there is no great choice. The White Muscatel is erratic in its fruiting, in addition to being more subject to disease. Doradillo, commonly called Late Sherry, is a useful late variety, but it needs considerable spraying to protect it from black spot. This latter is, however, not such a serious matter, for the reason that constant spraying is needed, irrespective of variety, in order to check downy mildew.

Out in the western and southern districts, where the climate is not so moist, there is a greater range in selection of varieties. At the same time there is no need to have a large number. The main object is to have vines adapted to the systems of training which it is proposed to adopt. For instance, if ordinary bush vines are desired, such varieties as Muscat Hamburg, Muscat Gardo Blanco, Doradillo, Red Prince, Flome Tokay, Waltham Cross, and Frontignac form a good selection. The same varieties may be trained on simple trellises as spaliers and cordons.

When it is desired to carry out a more elaborate system of training, such, for instance, as over a pergola, or to shade the side of a house, care should

be exercised in the selection of suitable varieties. Two of the best vines for this purpose are the Zante Currant and the White Crystal, because of their strong growth. In addition to these, other useful varieties are Sweet Water, Muscat Hamburg, Grand Turk, and Waltham Cross. All these latter varieties are strong growers when given fair treatment, and when assisted with liberal watering they will effectively cover an extensive area. Unless one has the means of promoting vigorous growth, it is a mistake to undertake too ambitious a scheme of training. It is far better to restrict the vines to one of the simpler forms, such as the bush cordon, or spalier. These have been fully explained in previous articles, so there is no occasion to make further reference to these systems.

Covering a pergola is a matter which requires a good deal of planning and patient construction. Probably the most common mistake made in this connection is to cover in the sides so as to exclude light, the result of which is to prevent the proper development and maturing of the fruit. The best plan is to build the whole of the fruit-bearing arms overhead, leaving a clean stem up to the height of the frame work. In this way, the fruit hangs down beneath the foliage, at the same time receiving ample air and light. A fringe of foliage will hang down over the side, forming a certain amount of shade and taking off the bareness from the sides of the structure.

Take, for instance, a structure intended to shade the side of a house. According to circumstances, the vines will be planted from 10 feet to 12 feet from the wall. Several posts about 8 feet apart and 7 feet out of the ground will be placed in line and connected with a stout top rail. The posts should be of 4 inches square hardwood, and the top rail 4 inches x 2 inches softwood, morticed on to and bolted to the tops of the posts. A wall plate will be needed just above the tops of the windows, say, 8 feet to 9 feet from the ground. Principals of 4 inches x 2 inches softwood and spaced 6 feet apart will connect the post line and the wall. Rafters of 3 inches x 2 inches softwood cross these at intervals of 3 feet to complete the structure. The vines will be planted 6 feet apart to correspond with the positions of the principals.

Training the Vines.

The stems will be 7 feet high, that is, the height of the posts, before any secondary arms are formed. This will necessitate considerable vigour, because a strong shoot must be secured to form the stem. If need be, it can be built up in sections, encouraging the topmost cane and tying it carefully to prevent breakage. It is a good plan to have a light rod from the base of the vine to the rail, up which the stem is trained for the first few years. As the stem becomes long enough, it is carried over the top of the structure to form the main arm.

From this point the formation resembles that laid down for cordon systems. The arm is trained from year to year until it reaches the wall. Spurs to form the secondary arms are spaced about 8 inches to 9 inches apart, and alternately on either side of the main arm. As the growth develops during the summer it spreads on either side of the arm, forming a thick canopy of

foliage over the whole of the top of the structure. The fruit bunches, as they form, hang down beneath this foliage, and in a good trellis present a very handsome appearance when ripe. The growth from the lower secondary arms will hang down over the side like a curtain.

The same plan may be followed out in covering any structure. The main point to be observed is the training of secondary arms as near as possible on horizontal lines. One advantage of a definitely planned structure is that it can easily be protected from birds by covering it with small mesh wire-netting or with bird nets.

Annual Pruning and Training.

During the growing period, the distribution of the foliage can be assisted by training the young canes and tying them in such a position as will distribute the growth. This operation also prevents a good deal of breakage by wind in the early portion of the season, while later on it means a better distribution of the fruit bunches.

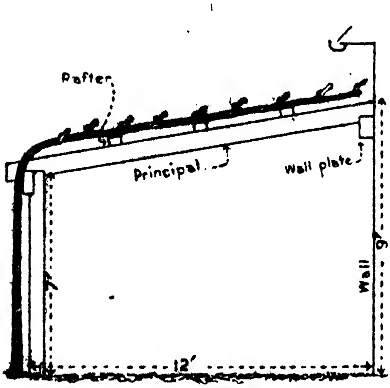


Fig. 24.—Vine trained on an elevated trellis against the side of a building.

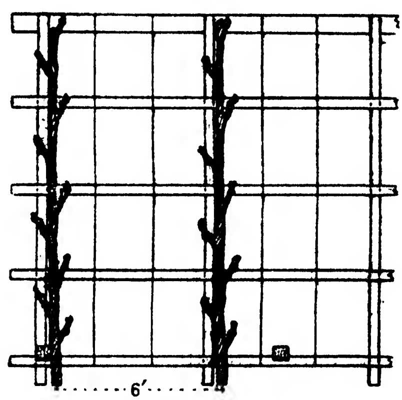


Fig. 25.—Front view of the same structure with the main arms of two vines, showing the spacing of the secondary arms.

The winter pruning is simple when the vines are formed. It consists in reducing each arm to one spur of two buds and removing all water shoots. Fig. 24 illustrates the elevation of the trellis, showing one vine fully developed. Fig. 25 shows a portion of the plan with the main arms of two vines. The system can be extended to any number.

It is sometimes desired to train vines upon a verandah, in which case the same principle can be carried out. The stem is trained to nearly the height of the verandah posts, and the arms are then built up as spaliers or cordons, the annual growth hanging down curtain-like.

When it is specially desired to enclose the sides of a structure, the object can be achieved by training cordons at varying heights upon supporting wires.

Another case may arise where the vines are planted on either side of a pathway covered by a trellis. In order to shade such a structure the vines may be trained as cordons alternately from either side.

Vines are sometimes grown against a wall which it is desired to cover up. In the first place it will be necessary to erect some supporting timber structure, with wires at varying heights. Upon these wires the arms of the vines will be trained in such a manner as to cover the wall completely.

School Experiment Plots at Yass.

Mr. G. H. Wright, H.D.A., District School, Yass, has forwarded to the Department a comprehensive report of cereal trials conducted last season on the school plots, which shows that some interesting work has been done that is bound to have a valuable influence on the boys' knowledge of agriculture.

The climate in this district is temperate, but severe frosts occur sometimes up to the end of October. Last year's rainfall (31·29 inches) was appreciably over the average, and the moisture received during the growing period was abundant. The soil in which the experiments were conducted was a sandy loam, but not of alluvial deposit form, although the plots were situated on a river bank.

Trials were conducted with wheat, oats, and barley, but as the summer vacation occurred at the time the grain was ripening it was necessary to treat all the crops as hay crops. Each plot received a thorough tilling to a depth of 6 inches and a fine seed-bed resulted. Of the eleven varieties of wheat under test, Yandilla King gave the best yield, which was estimated at 4 tons 3 cwt. per acre. This variety was sown at the rate of 65 lb. seed, with 70 lb. superphosphate per acre. The fact that the hay was weighed while very green made the estimated yield particularly heavy, but the variety seemed especially suited to the district. A fertiliser test with Firbank wheat gave results strongly in favour of the use of superphosphate, the fertilised portion of the crop germinating ahead of the unfertilised portion, maintaining its lead during growth, and proving more even and vigorous throughout.

Such experiments as these cannot but be of value to scholars attending schools in rural districts and to local farmers. A wider appreciation of their worth must tend to better farming methods throughout the State.

A Novelty in Beetle Destruction.

The Forestry Commission lately had success with a novel method of dealing with beetles that were attacking young Kurrajong plants in the acclimatisation area at Dubbo. The beetle in question was the grey-banded leaf weevil (*Ethamaia sellata*), a native insect that is very common in gardens, where both larvæ and beetles often attack carrots and other ground vegetables. The method adopted—as described by Mr. W. Watson, Secretary to the Commission, in a letter on the subject—was to water the plants well every morning and then to dust them well with finely sifted lime, care being taken that the lime was also on the soil around each seedling. In the morning the dead weevils could be gathered up by the dozen in a shrivelled condition. This was done for about a week, and there has been no further trouble.—W. W. Froggatt, Government Entomologist.

Diseases of Bees in New South Wales.

[Concluded from page 54.]

W. A. GOODACRE, Senior Apiary Inspector.

As previously mentioned, the diseases of the adult bee are somewhat obscure: one set of symptoms or another will usually enable the practical apiarist to make such a diagnosis as "paralysis," "spring dwindling," "dysentery," &c., but microscopical examination of diseased bees in the laboratory has resulted in the identification of only one organism—*Nosema apis*. Whether this parasite is responsible for all adult bee diseases has not been clearly proved. We do know that bees in New South Wales show great immunity from diseases of the adult bee, and it is almost impossible to infect healthy, vigorous bees, even by interchange of brood and bees from diseased stocks. Although the diseases do not come in epidemic form, they are sufficiently serious to warrant preventive measures and prompt treatment.

Spring Dwindling.

Conditions that tend to lower the vitality of bees during winter have the effect of causing losses in spring—hence, "spring dwindling." Wintering bees in low-class hives, which allow excessive draught through the cluster, compels extra activity and the consumption of extra food if the temperature of the hive is to be maintained. Such conditions (especially if there is any shortage of food) affect the vitality of the bees, and when heavy spring work has to be carried out, a fairly rapid dying off is noticeable. Abnormal autumn conditions, or a poor class of winter food, have a similar effect.

The symptom usually noticed in spring dwindling is the abnormal number of dead bees that are thrown out, and piled up on the ground near the entrance. In severe cases the dwindling may cause the colony to get so weak that there is small chance of it recovering. While the bees generally die in the natural way mentioned, it is at times found that the lowered vitality allows the entry of the organism *Nosema apis*. In such cases, the dying bees usually assume a characteristic, pinched-up condition, and some of the legs are in quite unnatural positions.

Locality plays an important part in spring dwindling—the disease is more noticeable in poor localities than in the commercial bee-keeping centres. The presence of young queens and good brood combs in the hives during autumn, and the provision of sound hives and stores of good quality for the winter, are the best preventive measures. Colonies usually recover from the disease when stimulating conditions again obtain, but it is advisable during the early spring to make affected colonies as comfortable and compact as possible, and it is sometimes as well to give a change in food by feeding a few pounds of sugar syrup.

Care should be taken to minimise the risk of spring dwindling, for the population of the colony during spring is an important factor, both for the production of honey and the increase of stocks.

Dysentery.

Dysentery in bees, so far as New South Wales is concerned, may be classed as a symptom of a disease, rather than as a disease in itself. Our sunny climate, which allows the bees, even during winter, to make cleansing flights, does much towards preventing such trouble. When dysentery is noticed, it can usually be traced to a poor food supply. It is often a symptom in paralysis, and occasionally in spring dwindling. Spotting of excrement and a foul odour, noticeable about the entrance, are significant signs.

When dysentery is not associated as some symptom of another disease, a change in food (such as sugar syrup fed warm inside the hive) will usually do much to relieve the bees.

Paralysis.

For a description of this disease and some significant experiments in relation to it, the reader is referred to an article that appeared in this journal in May, 1920.

In this State the disease affects the colonies during the active part of the season, and appears in two noticeable forms. The signs pointing to what may be termed a genuine case of bee paralysis are :—(1) Bees dead and dying about the entrance to the hive; (2) bees partially paralysed and with abdomen distended; (3) bees with a trembling movement and with wings spread out; (4) bees with a greasy and shiny appearance.

The other form of paralysis occurs in a milder form and is more prevalent. Indications of its presence are :—(1) Bees dead and dying about the entrance; (2) bees partially paralysed and with abdomen somewhat distended; (3) bees with wings appearing as if damp with nectar. In the milder form of paralysis the reader will note the absence of the outspread wings and of the trembling.

Genuine paralysis is probably hereditary, for there is ample proof that a good deal of the fault lies in the breeding of the affected colonies. The milder form is usually traceable to digestive troubles or lowered vitality due to various causes, and it disappears under improved conditions without treatment.

Isle of Wight Disease.

The name Isle of Wight was given to a serious epidemic disease of the adult bee as it occurred in Great Britain. The symptoms are somewhat similar to those noticed in our paralysis of bees, and there has been a good deal of discussion as to the relationship of the two diseases. The serious epidemic destructiveness associated with the Isle of Wight disease in Great Britain does not occur, however, in any of the diseases affecting the adult bee in this State, and from the conclusions recently arrived at by British investigators it would appear that Isle of Wight disease is so far non-existent outside Great Britain.

Research has for some years been carried on in connection with Isle of Wight disease by investigators working under a special Joint Committee of the University and the College of Agriculture at Aberdeen (Scotland), and their extensive experiments and inquiry enabled an announcement of considerable significance to be made at a recent meeting of the Royal Society of Edinburgh. It was stated that, in the opinion of the investigators, the idea hitherto held that the causal organism was protozoan, namely, *Nosema apis*, was erroneous, and that while *Nosema apis* had been shown to be a harmful parasite to bees, it was not causally related to the disease in question, which now appeared to be due to a remarkable type of parasitism in bees previously unknown.

The harmful parasite, an extremely small mite belonging to the genus Tarsonemus, invaded the respiratory system of the bee, and within the space of a few cubic millimetres in this region scores of these creatures might be found in all stages of development, sometimes packed in dense columns, so as effectively to cut off the air supply from the surrounding organs. Thousands of bees had been examined from large numbers of stocks throughout the country, and in all cases stock reported by reliable bee-keepers or certified by the investigators as suffering from the disease were found to be harbouring this parasite. Many bees from different countries outside Great Britain had been examined, and so far the parasite had not been found in any of these.

Wax Moths.

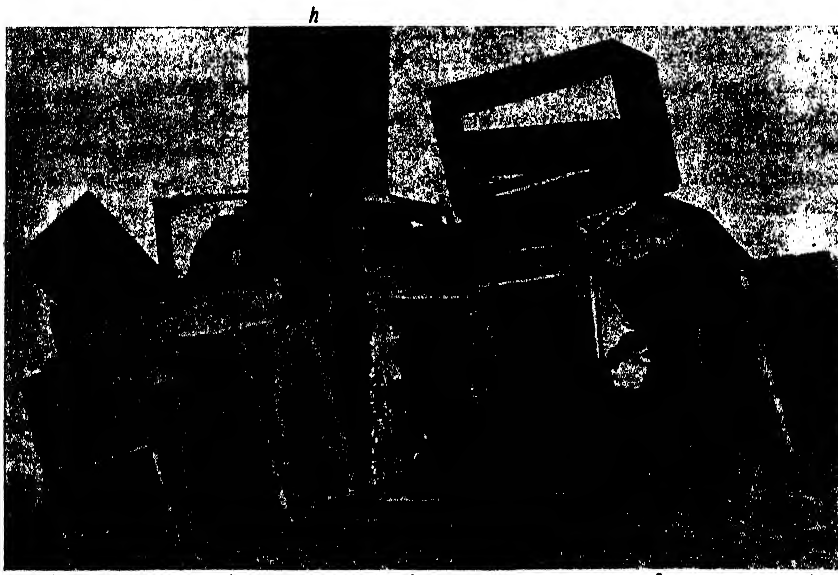
This is properly an apiary pest rather than a bee disease, but it is such a common nuisance that it may well be dealt with here. Competent apiarists do not consider the wax moth larvæ a serious pest, the prevention of serious damage by them being a comparatively simple matter, though where combs have to be stored some care must be taken to prevent their destruction. In the case of the careless or incompetent apiarist, however, matters are quite different; large numbers of valuable combs are often destroyed by this pest where preventive measures are not employed, while the opportunities which allow the wax moth larvæ to thrive often also allow the spread of other diseases such as foul brood. It was to keep the wax moth under control and to prevent the spread of brood disease that the pest has been classed as a disease under the Apiaries Act.

The accompanying illustration shows clearly the damage done to valuable combs, and the breeding grounds offered to the pest by careless bee-keepers. Inspectors under the Apiaries Act have caused a good deal of such material to be cleaned up. To leave hives containing combs, not in use by the bees, so that they are eventually riddled with wax moth larvæ in the manner shown is inexcusably careless. If it is not intended to save the combs they should be melted up.

There are two species of wax moth which are generally noted for destructive work, namely, the larger wax moth (*Galleria mellonella*) and the lesser wax moth (*Achroia grisella*). The larva of the latter is distinguished by its yellow head. Of the two species, the larger (*Galleria mellonella*) is the most

destructive and the most common. Combs in which brood has been raised are more liable to attack than white combs in which honey only has been stored. The pest is most destructive during spring and summer.

If a slightly infested comb is held towards the light a few web lines will be noticed about the midrib of the comb, and if the conditions are favourable for the pest it does not take long for the larvæ to riddle the combs and almost cover them with web work. If the larvæ under the protecting web work are examined they will be found to measure nearly an inch in length when full-grown. At the end of the larval stage they spin a tough silk cocoon from which the moth finally emerges. In a heavily infested hive these cocoons are thickly matted together about the top bars of the frames and on other woodwork about the hives.



A Menace to every Neighbouring Bee Farmer.

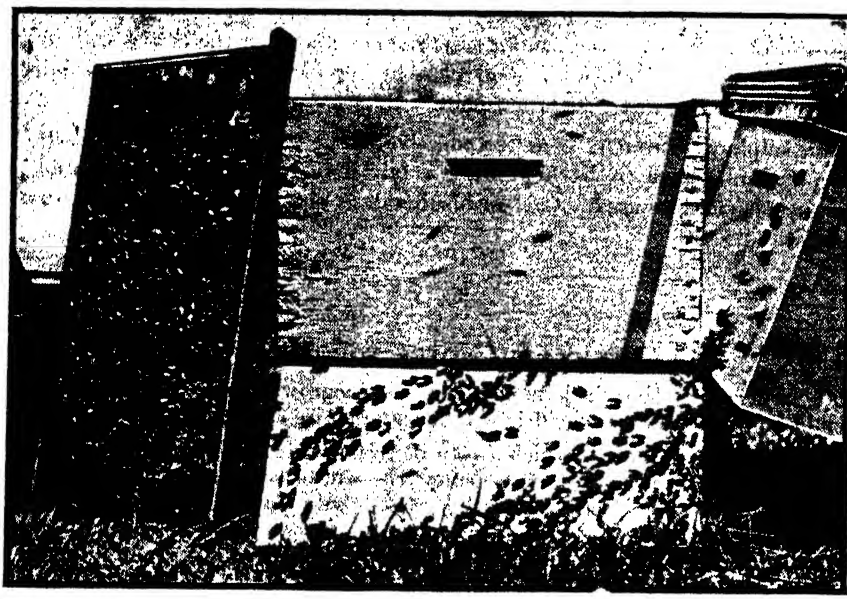
a and *b*. Frames containing comb completely riddled by larvæ.
c. New comb with the portion containing brood affected, and the portion containing honey quite free.
d. Comb completely eaten away, and thousands of the cocoons of the moth in evidence.
e and *g*. A network of moth larvæ.
f. Comb practically eaten away.
h. The eight frames were completely webbed together, and could be taken out as one mass.

It is only in exceptional cases that the wax moth larvæ do any damage to combs in hives where bees are present. An apiarist having weak colonies of black bees may have some trouble, but where the Italian bee, or even a good vigorous crossbred is kept, trouble is rarely experienced. Should a few wax moth larvæ be present on the brood they can be traced by the aid of the web line and destroyed. In most cases where the beginner is under the impression that wax moth has destroyed his colonies, careful observation would have disclosed the fact that the pest got in after the bees had died out or had dwindled down to a mere handful.

If good, correctly-spaced material is used, and the colonies are compact and of Italian strain, no trouble will be experienced with the wax moth larvæ inside the hive.

Care of Surplus Combs.—When combs have to be stored for any length of time, care should be taken to prevent damage by the wax moth larvæ, for such combs are of great value for future development in the apiary. Bees will store honey in combs at times when they will not build out comb foundation.

As the pest is not so troublesome during the winter months, the removal of one comb from each body and the piling up of the bodies on four tins, so as to prevent damage by mice, will usually suffice as a protection. No cover or bottom board should be used, so that air may circulate through the pile freely.



Good colonies well hived prevent wax moth.

The room in which the bodies are stored must be bee-proof, to prevent any robbing by bees. Some apiarists place a wire cloth screen top and bottom of the pile. The combs should be examined about once a month during the winter, and any showing signs of infestation should be set aside for fumigation. During the early spring populous colonies of Italian bees will take care of a few of the surplus bodies and combs.

The remaining piles should be treated in the following manner, described by Dr. Miller in the *American Bee Journal*:—First scrape all propolis from the top and bottom edges of the supers, in order that the bodies may fit tight, and thus retain the gas. On top of each set of combs place a cloth about 10 inches square (doubled) and over this pour a tablespoonful of carbon

bisulphide. Cover the cloth with two thicknesses of newspaper to ensure a tight joint, and place another body on top and treat in the same way, continuing as high as you wish to go.

Carbon bisulphide is a poisonous and very inflammable gas, and great care is therefore necessary in its use. Fumigation is best carried out under a verandah or in the open, and if the work is done indoors there should be ample opportunity for the free circulation of air if risk to the operator is to be avoided. On no account should a light of any sort be allowed in the vicinity of the gas, as a spark is quite sufficient to cause an explosion.

Fumigation by Sulphur Fumes.—Sulphur fumes, when united with air, form a gas known as sulphur dioxide, and are quite effective in destroying larvæ in slightly infested combs, but heavily infested combs should be melted up. To fumigate with sulphur, prepare four or five bodies of combs, get a pan containing red-hot coals, on which a handful of sulphur is thrown, and immediately place over the pan an empty super, and then the bodies containing the combs; finally place a good close-fitting cover over all. The combs can be left for one hour over the fumes.

The sulphur treatment is not so effective as the carbon bisulphide; therefore, if combs have to be kept over a fair period, the carbon bisulphide treatment should be used. Carbon bisulphide is obtainable from almost any chemist.

Vineyard Notes for May.

May is generally the slack month for the vinegrower, and the opportunity should be taken to do any odd jobs that may require attention.

In the young vineyards which are to be trellised, it is advisable to try and complete the erection of the posts before the winter sets in, as the work can be done without the break of weather that would probably be experienced later on. The carting out and erection of posts under dry conditions simplifies matters considerably, and gives one the benefit of the winter rains—consolidating the soil around the posts, which are therefore better able to stand the straining of the wire later on.

It is a good plan first to tighten up the wires with the hand the first year, leaving proper straining until the following season. The wires should be run before the growth starts in the spring, to avoid knocking off the young shoots.—H. L. Manuel, Viticultural Expert.

Seed of Sudan grass and the sorghums is obtainable from the Department at the following prices:—Sudan grass, 6d. per lb.; Saccaline, 6d.; Early Amber cane, 4d.; grain sorghums, 6d. Applications should be addressed to the Under-Secretary and Director, Department of Agriculture, Sydney.

Egg-laying Tests at Hawkesbury Agricultural College.

(Under the Supervision of James Hadlington, Poultry Expert.)

NINETEENTH YEAR'S RESULTS, 1919–20.

F. H. HARVEY, Organising Secretary.

THE Nineteenth Egg-laying Competition at Hawkesbury Agricultural College concluded on 31st March, and the record of the results is now presented. The competition was controlled by a committee of management, comprising four officers of the Department of Agriculture and three competitors' representatives, namely, the College Principal (Mr. H. W. Potts, lately succeeded by Mr. E. A. Southee), Messrs. James Hadlington (Poultry Expert, Department of Agriculture), C. Lawrence (Poultry Instructor, Hawkesbury Agricultural College), A. E. Brown, C. Judson, and E. T. Rhodes (competitors' representatives), and Mr. F. H. Harvey (Department of Agriculture), Organising Secretary.

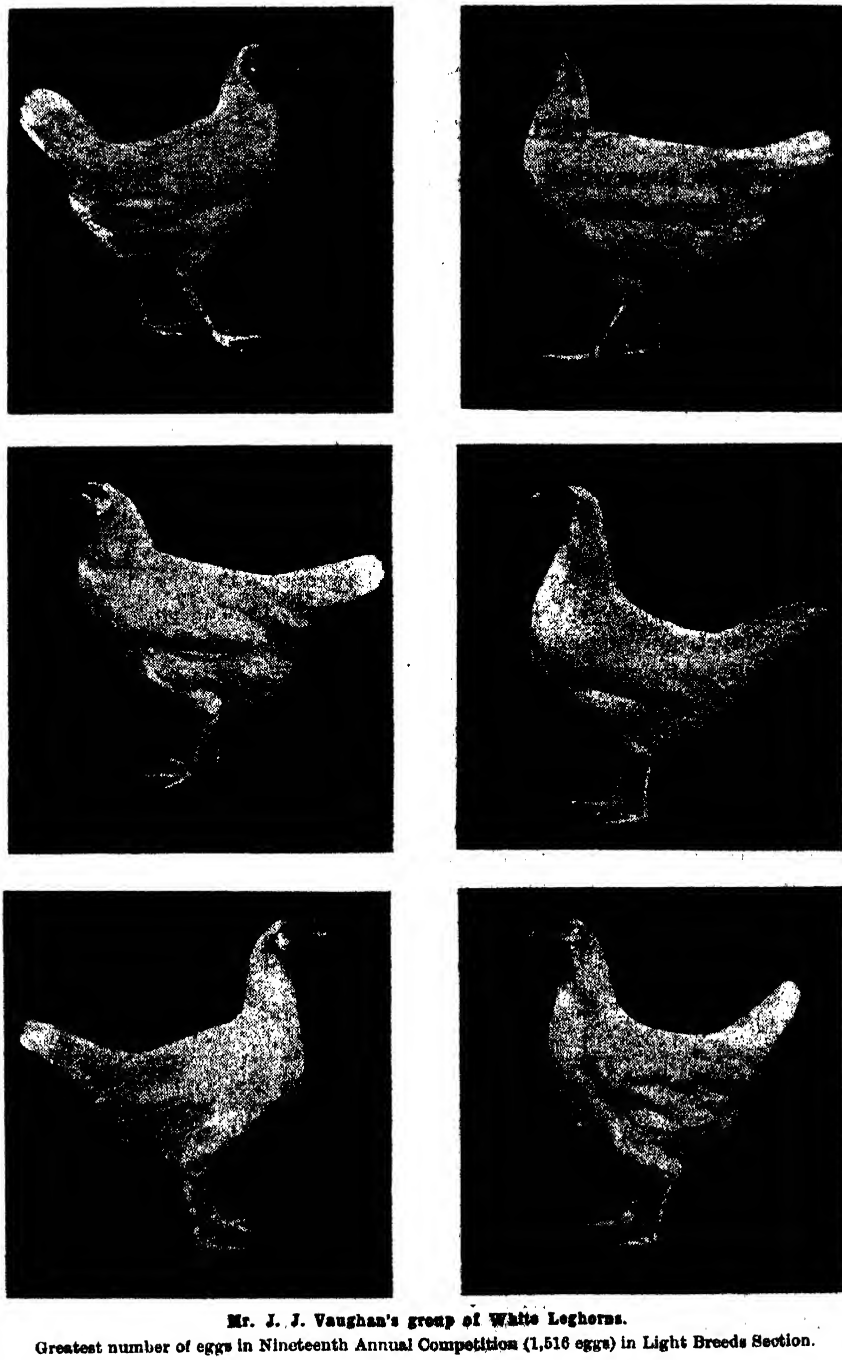
Scope of the Competition.

This marks the second year in which competitions were provided for standard-bred birds, the qualification for entry in these sections being that the owner had won a first, second, or third prize with the particular breed entered in an "open show class" at an approved exhibition held in New South Wales during the previous three years.

The competitions were limited to pullets between seven and twelve months' old on 1st April, 1920, and pens were allotted as follow :—

	Groups.	Birds.
Section A.		
Open Light Breeds :—		
White Leghorns ..	31	186
Anconas	1	6
Minorcas	1	6
Section B.		
Open Heavy Breeds :—	32	192
Black Orpingtons ..	11	66
Langshans	3	18
Silver Wyandottes ..	1	6
Plymouth Rocks ...		

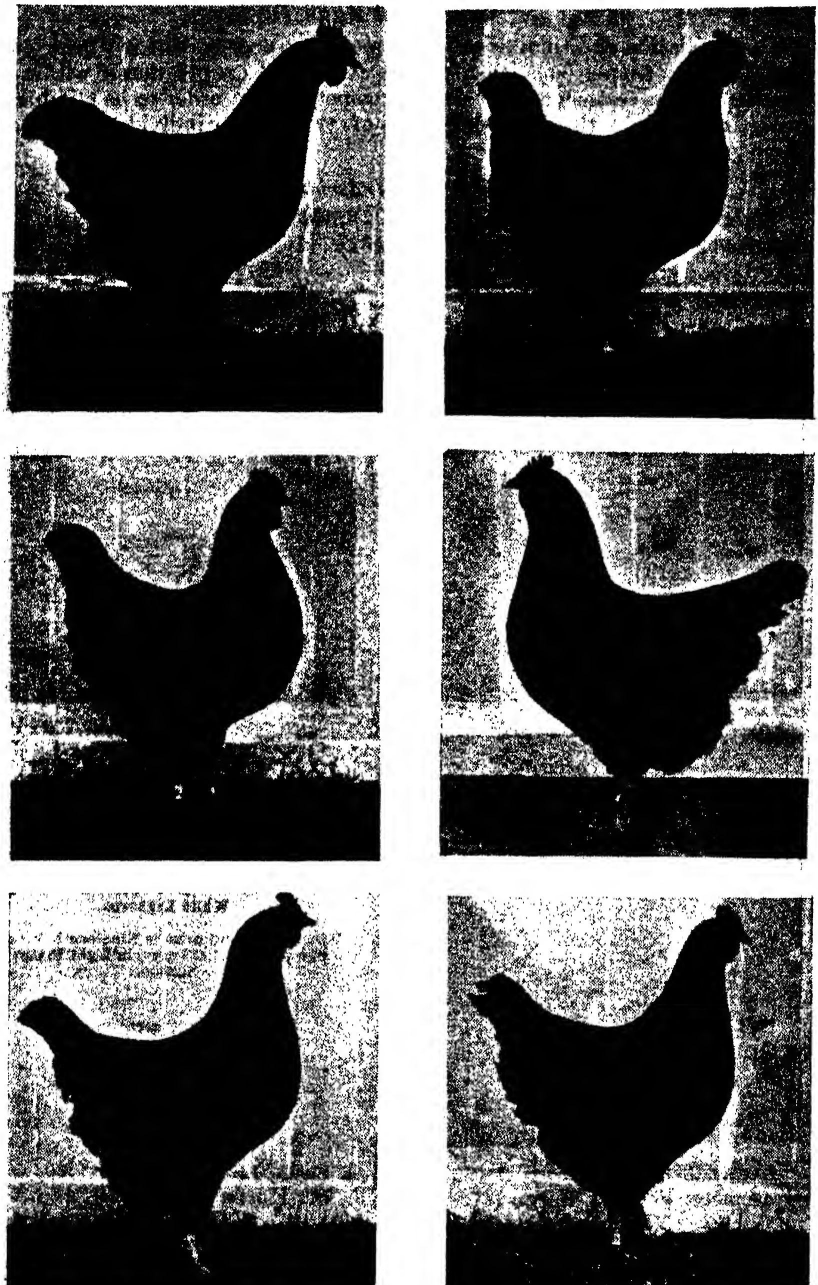
	Groups.	Birds
Section C1.		
Standard Light Breeds :—		
White Leghorns ...	4	24
Minorcas ..	1	6
Section C2.		
Standard Heavy Breeds :—		
Rhode Island Reds ..	2	12
Silver Wyandottes	1	6
Plymouth Rocks	1	6
Langshans . .	1	6
Total	90	540



Mr. J. J. Vaughan's group of White Leghorns.

Greatest number of eggs in Nineteenth Annual Competition (1,516 eggs) in Light Breeds Section.

A—1 hen (No. 456) was the winner of prize for greatest number of eggs laid by an individual hen in the section (252 eggs).



A

Mr. J Wheller's group of Black Orpingtons.

Greatest number of eggs in Nineteenth Annual Competition (1,188 eggs) in Heavy Breeds Section

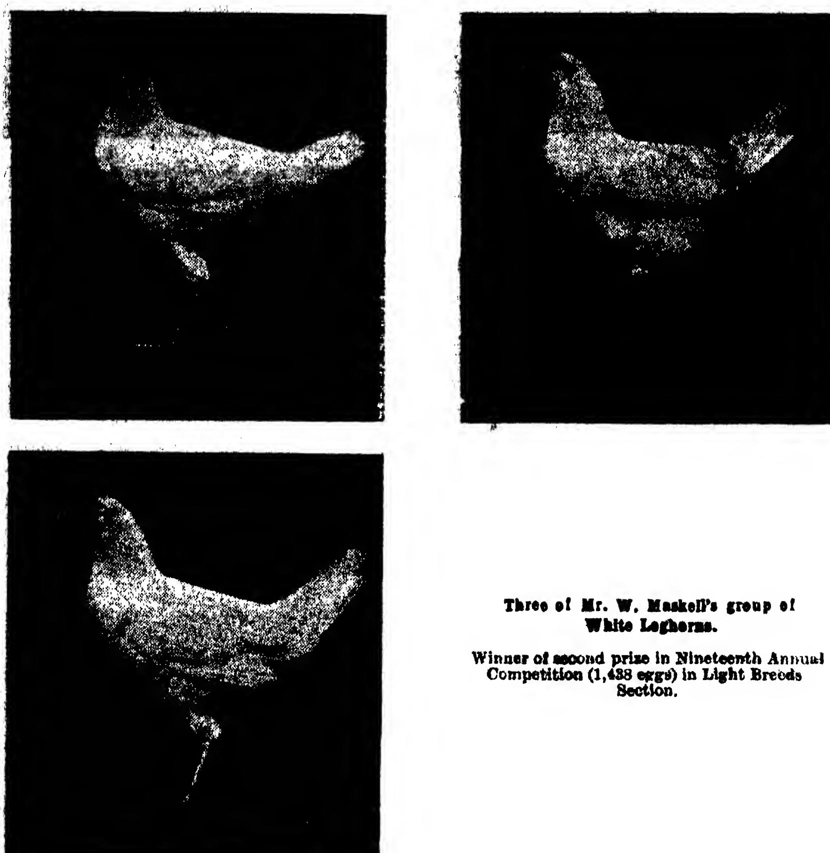
A—This hen (No. 190) won second prize for number of eggs laid by an individual hen in the section (304 eggs).

Weight of Eggs.

The regulation that individual hens must lay eggs of at least 2 oz. each, and that eggs from groups must average at least 24 oz. per dozen within six months of the commencement of the competition, in order to be eligible for prizes, resulted in the disqualification of twenty-two individual hens and three groups, as follows:—

Disqualified from Individual Prizes.

Light Breeds.—J. Anderson (No. 292); M. McInnes (No. 399); E. T. Rhodes (No. 436); R. Whitelaw (No. 461).



Three of Mr. W. Maskell's group of White Leghorns.

Winner of second prize in Nineteenth Annual Competition (1,438 eggs) in Light Breeds Section.

Heavy Breeds.—Alcorn Bros. (Nos. 4 and 5); C. Dawson (No. 24); Grasemere Poultry Farm (No. 77); F. S. Horner (Nos. 79 and 81); G. Jobling (No. 90); B. A. Maher (No. 128); C. Ray (No. 160); J. Every (No. 228); H. Hollibone (No. 246); W. H. Forsyth (No. 260); R. S. Muir (Nos. 272 and 276); J. D. Martin (No. 278); J. H. Madrers (No. 514); and F. M. Weierter (Nos. 523 and 528).

Disqualified from Group Prizes.

Heavy Breeds.—F. S. Horner (Nos. 79 to 84); R. S. Muir (Nos. 271 to 276); F. M. Weierter (Nos. 523 to 528).

Ration fed to the Competition Birds.

The birds were fed on a simple ration, which is best expressed as follows :—

The Morning Mash.		The Evening Ration of Grain.
Pollard	60 per cent.	Two-thirds wheat.
Bran	20 ,,	One-third crushed maize.
Lucerne dust*	15 ,,	
M.I.B. meat meal ...	5 ,,	

Common salt was added at the rate of 4½ oz. to each 20 lb. (or bushel) of mash.

* When obtainable, its equivalent in bran was used.

The nutritive ratio of the above feed for the day is approximately 1 to 4·5.

Mixing Mash for Adult Birds.—The proportion by weight of bran or bran and lucerne dust is added to the meat meal; then there is poured over it sufficient liquid into which has been dissolved a quantity of common salt equal to 4½ oz. for each 20 lb. of food to be mixed. The bran then resembles a wet mash in the form usually given to horses or cattle; the proportion by weight of pollard is then mixed thoroughly into a mash of a consistency that can be balled by the hands under slight pressure, and will fall to pieces when thrown down. Should the pollard be of a coarse description, less bran is used. On the other hand, should it be fine, more bran is used. The nutritive value of both is so nearly identical that, from that point of view, the proportions are immaterial.

As much chaffed green lucerne as the birds will eat is given at midday. The shell grit supplied consists of two-thirds sea-shell to one-third crushed oyster shell. This is, of course, always available to the birds.

Mortality and Disease.

It is pleasing to be able to record that the mortality for the year was considerably less than in the preceding year, being twenty-four as compared with forty-nine. The details were :—

	1919-20.		1920-21.	
	Light Breeds.	Heavy Breeds.	Light Breeds.	Heavy Breeds.
Birds replaced	7	13	1	4
Birds not replaced	11	18	8	11

THE MONTHLY LAYING.

Month.	Section A. Light Breeds.		Section B. Heavy Breeds.		Section C1. Light Breeds.		Section C2. Heavy Breeds.	
	Total for 198 hens.	Average per hen.	Total for 282 hens.	Average per hen.	Total for 30 hens.	Average per hen.	Total for 30 hens.	Average per hen.
April, 1920 ...	1,495	7·6	2,701	9·6	146	4·8	196	6·5
May, ,, ...	2,543	12·8	4,242	15·0	334	11·1	343	11·4
June, ,, ...	2,937	14·8	5,213	18·4	386	12·8	423	14·1
July, ,, ...	3,546	17·9	5,828	20·6	531	17·7	535	17·8
August, ,, ...	4,228	21·3	6,471	22·9	603	20·1	659	21·9
September, ,, ...	4,412	22·2	6,239	22·1	660	22·0	667	22·2
October, ,, ...	4,604	23·3	5,862	20·8	662	22·1	643	21·4
November, ,, ...	4,135	21·5	4,949	17·5	638	21·3	537	17·9
December, ,, ...	3,668	18·5	4,548	16·1	506	16·8	550	18·3
January, 1921 ...	3,972	20·0	4,319	15·3	613	20·4	473	15·7
February, ,, ...	3,095	15·6	3,593	12·7	472	15·7	394	13·1
March, ,, ...	2,042	10·3	3,534	12·5	304	10·1	376	12·5
	40,677	205·4	57,499	203·9	5,855	195·2	5,796	193·2

Scores of Leading Birds.

The following table shows the monthly records of the ten leading birds in light and heavy breeds.

Owner and Breed.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
						Light Breeds.							
J. J. Vaughan: White Leghorn	12	22	22	25	25	25	30	23	25	28	21	24	282
R. G. Christie and Son: White Leghorn ..	10	21	22	25	26	24	25	27	24	23	26	24	277
E. T. Leane: White Leghorn	0	23	25	24	26	27	28	27	23	26	23	23	275
C. Leach · White Leghorn	14	19	12	21	26	26	28	27	22	29	24	24	272
J. Rayner: White Leghorn	6	25	22	23	25	27	26	23	24	25	23	19	268
W. Maskell: White Leghorn	11	25	20	22	23	25	27	24	24	24	21	21	267
J. J. Vaughan: White Leghorn	15	16	19	18	25	26	29	25	26	28	27	11	265
W. I. Baker: White Leghorn	14	21	23	23	27	25	25	23	18	21	21	22	263
W. J. Buckland: White Leghorn	17	19	22	23	25	24	26	27	21	24	22	18	263
C. McKendry: White Leghorn	20	22	21	22	23	24	25	24	21	22	18	18	260
						Heavy Breeds.							
R. H. Upton: Langshan	21	29	26	28	28	29	28	29	28	28	23	22	319
J. Wheller: Black Orpington	24	24	22	23	27	30	28	29	24	24	26	23	304
J. Wheller: Black Orpington	16	24	27	29	30	28	28	23	25	23	20	26	299
A. Collier: Langshan	20	27	25	24	24	27	27	27	26	26	21	22	296
A. E. Brown: Langshan	3	26	26	26	29	30	27	29	27	28	26	15	292
A. E. Brown: Langshan	23	23	24	25	26	29	27	22	27	14	24	22	286
W. Broughton: Langshan	22	25	21	23	25	25	25	24	27	22	21	20	280
R. H. Upton. Langshan	20	14	23	28	28	28	28	26	18	23	15	25	276
R. H. Upton: Langshan	19	22	22	22	23	25	26	26	26	24	20	20	275
P. G. Heath: Black Orpington	3	28	25	26	28	27	27	27	25	27	17	15	275

Weights of Winning Birds.

Weights of the winning pens at the beginning and end of the competition should be of interest. They were:—

		Weight at April, 1920.		Weight at March, 1921.	
Individual Hens.		lb.	oz.	lb.	oz.
Light Breeds—					
J. J. Vaughan's White Leghorn, No. 456 ...		3	12	4	0
Heavy Breeds—					
R. H. Upton's Langshan, No. 253		4	8	5	10
Groups.					
Light Breeds— J. J. Vaughan's White Leghorns, Nos.	451	3	8	4	2
	452	3	10	4	6
	453	3	10	4	0
	454	3	10	4	6
	455	3	8	4	0
	456	3	12	4	0
Heavy Breeds— J. Wheller's Black Orpingtons, Nos.	187	5	0	5	4
	188	5	8	6	0
	189	5	4	5	8
	190	5	2	5	8
	191	5	2	5	4
	192	5	0	6	8

The Financial Aspect.

The cost of feed for the 540 birds for the year was £341 15s. 10d., representing:—

		£	s.	d.
Wheat	383 bushels 15 lb. ...	143	14	5
Maize	136 ,, 49 ,, ...	52	13	0
Pollard	803 ,, 0 ,, ...	79	14	10
Bran	474 ,, 10 ,, ...	42	10	2
Green feed	83 cwt. 94 lb.... ..	4	4	0
Meat meal	1,460 lb.	12	1	4
Common salt	325 ,, ...	0	19	11
Epsom salts	52 ,, ...	0	8	2
Shell grit	55 cwt.	5	10	0

The average cost of feed per head was thus 12s. 8d.

The market value of the eggs laid was £1,018 11s. 9d., so that the profit over cost of feed was £676 15s. 11d., equal to £1 5s. 1d. per head.

Annual Competition.

Full details of the financial and other results since the inception of the competitions are given in the following comparative table:—

	No. of Groups.	Winning Total.	Lowest Total.	Highest Monthly Total.	Average per Hen.	Greatest Value.	Average Net Price of Eggs.	Average Value per Hen.	Cost of Feed per Hen.	Balance over Feed.
1st ...	38	1,113	459	137	130	140/-	1/1	15/6	6/-	9/6
2nd ...	70	1,308	666	160	163	150/-	1/3¾	17/9	5/9¾	12/-
3rd .	100	1,224	532	154	152	114/-	1/-	12/9	4/5½	8/3
4th ...	100	1,411	635	168	166	125/-	-/11½	13/3	5/3½	8/-
5th ...	100	1,481	721	162	171	137/-	1/0½	14/10	5/10	9/-
6th ...	60	1,474	665	161	173	149/-	1/2¼	17/2	7/-	10/2
7th ...	50	1,379	656	159	180	146/-	1/3¼	19/2	7/9½	11/4
8th ...	60	1,394	739	158	181	173/-	1/5¼	21/9	6/9	15/-
9th ...	40	1,321	658	151	168	134/5	1/2	16/3½	6/5½	10/2
10th ...	50	1,389	687	146	184	141/9	1/2½	18/5½	6/1½	12/4
11th ...	50	1,461	603	156	178	164/7	1/3½	19/4¼	7/3½	12/0¾
12th ...	50	1,360	724	152	177	145/3	1/2½	17/7	5/9	11/10
13th ...	63	1,541	705	162	181	152/9	1/2	17/8½	6/9½	10/11
14th ..	70	1,449	506	165	192	172/7	1/4½	22/2	7/7	14/7
15th A	40	1,526	924	162	216	171/11	1/3¾	28/8¾	6/10	16/10¾
15th B	30	1,479	749	165	192	171/3	1/3¾	21/7½	6/10	14/9½
16th A	40	1,525	923	157	209	166/2¼	1/4	21/9¾	7/8	14/1¾
16th B	30	1,613	931	170	202	172/3¼	1/4	21/2	7/8	13/6
17th A	40	1,448	860	153	199	168/3	1/5½	22/0½	7/10	14/2½
17th B	30	1,517	815	151	189	183/6¾	1/5½	21/11¼	7/10	14/1¼
18th A	30	1,438	988	148	203	207/6	1/10	28/10	9/3	19/7
18th B	50	1,428	745	151	190	210/7	1/10	28/1	9/3	18/10
18th C1	3	1,304	977	138	195	185/8	1/10	27/8	9/3	18/5
18th C2	7	1,336	955	150	191	190/7	1/10	28/5	9/3	19/2
19th A	33	1,516	996	167	206	282/11	2/2	37/11	12/8	25/3
19th B	47	1,488	955	168	204	283/-	2/2	37/11	12/8	25/3
19th C1	5	1,425	944	148	195	267/8	2/2	36/-	12/8	23/4
19th C2	5	1,298	1,020	150	193	244/8	2/2	35/9	12/8	23/1

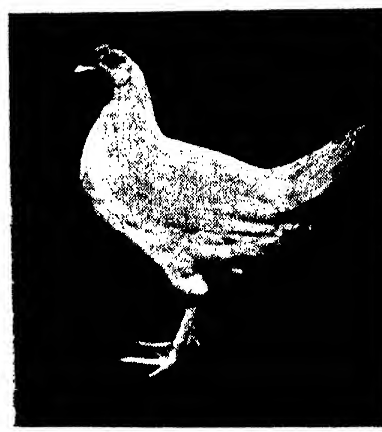
AWARDS OF PRIZES AND CERTIFICATES.

Grand Champion Prize.

Grand Champion Prize of £5 5s. (or trophy to that value), for greatest number of eggs laid in twelve months by group of six birds without replacement—J. J. Vaughan's White Leghorns, 1,516 eggs.

Sections A and C1 (Light Breeds).

Greatest number of eggs laid in twelve months (individual hens). Prizes, £3, £2 10s., £2, £1 10s., and £1.—J. J. Vaughan, White Leghorn, 282 [illegible] (1); R. G. Christie and Son, White Leghorn, 277 eggs (2); E. T. Leane, White Leghorn, 275 eggs (3); C. Leach, White Leghorn, 272 eggs (4); J. Rayner, White Leghorn, 268 eggs (5).



Three of Mr. C. McKendry's group of White Leghorns.

Winner of third prize in Nineteenth Annual Competition (1,425 eggs) in Light Breeds Section.

Greatest number of eggs laid in twelve months (groups of six birds). Prizes, £2 10s., £2, £1 10s., and £1.—J. J. Vaughan, White Leghorns, 1,516 eggs (1); W. Maskell, White Leghorns, 1,438 eggs (2); C. McKendry, White Leghorns, 1,425 eggs (3); W. T. Baker, White Leghorns, 1,419 eggs (4).

Quarterly prizes (groups of six birds) :—

Winter test (1st April to 30th June, 1920). Prizes, £2 and £1 10s.—W. J. Buckland, 323 eggs (1); A. Windeyer, 315 eggs (2).

Spring test (1st July to 30th September, 1920). Prizes, £1 10s. and £1.—J. J. Vaughan, 420 eggs (1); W. Maskell, 412 eggs (2).

Summer test (1st October to 31st December, 1920). Prizes, £1 10s. and £1.—J. J. Vaughan, 464 eggs (1); W. Maskell, 433 eggs (2).

Autumn test (1st January to 31st March, 1921). Prizes, £2 and £1 10s.—J. J. Vaughan, 379 eggs (1); C. Leach, 367 eggs (2).

Highest average for twelve months (groups of six or five birds). Prizes, £3, £2 10s., £2, and £1 10s.—J. J. Vaughan (average 253 eggs) (1); W. Maskell (average 240 eggs) (2); C. McKendry (average 237 eggs) (3); W. I. Baker (average 236 eggs) (4).

Sections B and C2 (Heavy Breeds).

Greatest number of eggs laid in twelve months (individual hens). Prizes, £3, £2 10s., £2, £1 10s., and £1.—R. H. Upton, Langshan, 319 eggs (1); J. Wheller, Black Orpington, 304 eggs (2); J. Wheller, Black Orpington, 299 eggs (3); A. Collier, Langshan, 296 eggs (4); A. E. Brown, Langshan, 292 eggs (5).

Greatest number of eggs laid in twelve months (groups of six birds). Prizes, £2 10s., £2, £1 10s., and £1.—J. Wheller, Black Orpingtons, 1,488 eggs (1); R. H. Upton, Langshans, 1,483 eggs (2); J. R. Jobling, Black Orpingtons, 1,448 eggs (3); A. E. Brown, Langshans, 1,409 eggs (4).

Quarterly Prizes (groups of six birds) :—

Winter test (1st April to 30th June, 1920). Prizes, £2 and £1 10s.—R. H. Upton, 366 eggs (1); A. H. Moxey, 363 eggs (2).

Spring test (1st July to 30th September, 1920). Prizes, £1 10s. and £1.—P. G. Heath, 447 eggs (1); C. Faulkner, 443 eggs (2).

Summer test (1st October to 31st December, 1920). Prizes, £1 10s. and £1.—J. R. Jobling, 419 eggs (1); Herbert Bros., 408 eggs (2).

Autumn test (1st January to 31st March, 1921). Prizes, £2 and £1 10s.—J. R. Jobling, 403 eggs (1); J. Wheller, 328 eggs (2).

Highest average for twelve months (groups of six or five birds). Prizes: £3, £2 10s., £2, and £1 10s.—J. Wheller (average 248 eggs) (1); R. H. Upton (average 247 eggs (2); J. R. Jobling (average 241 eggs) (3); A. E. Brown (average 234 eggs) (4).

Quality Prizes.

Highest records of pens selected in utility open sections of birds most closely conforming to standard type. Prizes in each of Sections A and B, £5 and £2 10s.

Section A.—J. J. Vaughan, 1,516 eggs (1); W. Maskell, 1,438 eggs (2).

Section B.—R. H. Upton, 1,483 eggs (1); C. Judson, 1,379 eggs (2).

Prizes in each of Sections C1 and C2, £2 and £1.

Section C1.—C. McKendry, 1,425 eggs (1); A. Messervy, 1,203 eggs (2).

Section C2.—W. Townsend, 1,298 eggs (1); J. Waterhouse, 1,176 eggs (2).

Certificates.

For pens having record of 1,350 eggs or more for twelve months :—

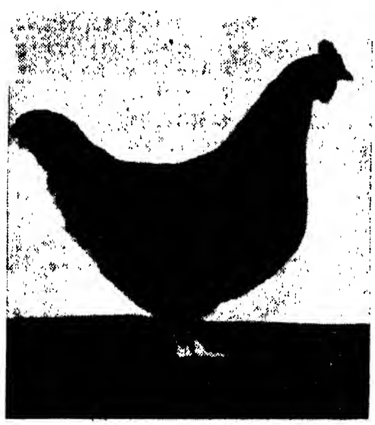
Light Breeds:—J. J. Vaughan (1,516); W. Maskell (1,438); C. McKendry (1,425); W. I. Baker (1,419); W. J. Buckland (1,400); J. Rayner (1,369); Mrs. M. Chalmers (1,368).

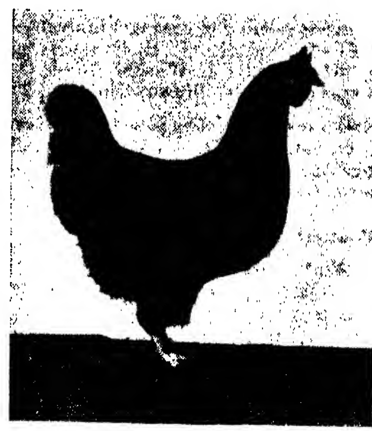
Heavy Breeds:—J. Wheller (1,488); R. H. Upton (1,483); J. R. Jobling (1,448); A. E. Brown (1,409); C. Judson (1,379); P. G. Heath (1,367); H. Hollibone (1,365); J. King (1,352); E. C. Reynolds (1,352).

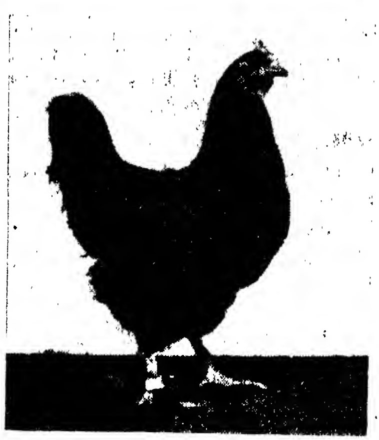
THE POULTRY EXPERT'S REVIEW.

The most gratifying, and, at the same time, the most important feature of the 1920–21 test, is the return to a higher general average than was put up during the two previous tests. The general average over both the utility sections (204·5) has been exceeded but twice during the series covering nineteen years, and these followed upon the imposition of the minimum weights in the fifteenth and sixteenth tests, when 205 and 206 respectively were attained. The group totals have been exceeded five times during the series of tests, while that of the best single hen with 319 is within 5 eggs of the record (324 eggs) established at the College in the seventeenth test.

A







Three of Mr. R. H. Upton's group of Langshans.

Winner of second prize in Nineteenth Annual Competition (1,483 eggs) in Heavy Breeds Section

A—This hen (No. 253) was winner of prize for greatest number of eggs laid by an individual hen in the section (319 eggs).

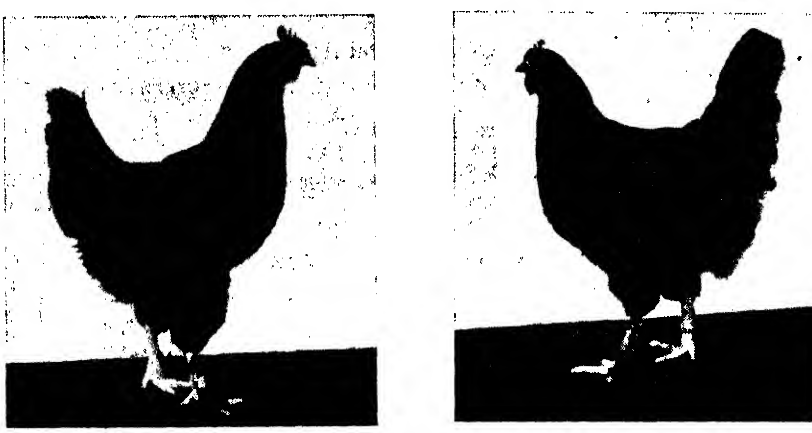
Special interest attaches to the light-breed section from the fact that the winner this year (Mr. J. J. Vaughan) was also the winner in the same section last year—the tally for the group this test being 1,516 eggs, beating his previous performance by 78 eggs, his best hen having laid 282 eggs. Mr. Maskell's group came second with 1,438 eggs, and Messrs. R. G. Christie & Son came second in single hens with 277 eggs.

In the heavy-breed section the contest between Mr. Wheller's Black Orpington group and Mr. Upton's Langshan's was a close one—so close that in the second last week of the test there was only 1 egg between them, the Wheller group finishing 5 eggs to the good. The best hen of this group laid 304 eggs, while Mr. Upton's best hen laid 319 eggs, which is within 5 eggs of the record for the College established by Mr. A. Drayton's Black Orpington which laid 324 eggs in the 1918–19 competition.

The general average over both the utility sections (Sections A and B) was 204·5. If the standard sections be included, the average would be 203·4. For purposes of comparison with previous averages, the A and B (204·5) should be used.

The Standard Sections.

The standard sections in this, as in last test, put up very creditable performances, the highest total in the groups being secured by Mr. C. McKendry (light breeds) with 1,425 eggs, the best hen of which group laid 260 eggs. If in the open utility section, this group would stand third among the light



Two of Mr. W. Townsend's group of Langshans.
Winner of the quality prize in Heavy Breeds, Standard Section.

breeds. In the heavy-breed section, Mr. Townsend made a fair showing with 1,298 eggs for the group, his best hen laying 256. The average for light breeds in the standard section was 195, while that of the heavy breeds in the same section was 193, or an average of 194. Notwithstanding that the general average and the group figures in this section are somewhat lower than those of the open utility section, they are sufficiently convincing of the fact that there is still nothing incompatible with standard quality and high egg production. It is all the more so considering that this is only the second test of standard quality, and that breeders for exhibition are not credited with having paid any attention whatever to breeding for egg-production. If this is acknowledged, it has to be admitted that, considering the large number of tested hens turned out of this and other competitions, either the hereditary

factors in production have fallen short of expectations, or the hens so tested have not been put to the best use, otherwise the winning totals and general averages of egg-production should be higher than they have been. The only real spurt in egg-production appears to be traceable rather to better physique and better selection during the 15th, 16th, and 19th tests rather than to the factor of heredity.

Bring up Low Producers.

The competitions appear to have reached a stage where record-breaking tallies must become more rare than in the past, owing to the fact that we are nearing the limits of reasonable expectations in high production in so far as group tallies and single hens are concerned. But there is still very material scope for making higher general averages by bringing up the low producers nearer to the high.

This is the feature upon which competitors will do well to concentrate. In securing better physique, and making better selections, apparently lies the best promise of immediate improvement on our already excellent performances.

Detailed Returns.

EGG-YIELDS OF EACH BIRD AND GROUP IN THE NINETEENTH ANNUAL COMPETITION.

Section A—(Light Breeds).

Owner and Breed.	Totals of Individual Birds.						Total of Groups.	Weight of Eggs per dozen.	Total Market Value.		
								oz.	£	s.	d.
J. J. Vaughan : White Leghorns	265	240	255	255	219	282	1,516	25¾	14	2	11
W. Maskell : White Leghorns	225	236	254	267	220	236	1,438	26¼	13	8	0
W. I. Baker : White Leghorns	216	212	227	253	263	248	1,419	24½	13	6	10
W. J. Buckland : White Leghorns	218	242	263	253	233	191	1,400	27¼	13	4	5
J. Rayner : White Leghorns	229	227	225	268	221	199	1,369	27	12	16	2
Mrs. M. Chalmers : White Leghorns	227	215	210	250	224	242	1,368	26¼	12	16	2
E. T. Rhodes : White Leghorns	229	180	223	247‡	230	230	1,339	25	12	7	4
E. T. Leane : White Leghorns	230	228	176	219	275	209	1,337	25¾	12	6	0
C. Leach : White Leghorns	202	244	272	196	234	184	1,332	26¼	12	5	3
R. G. Christie and Son : White Leghorns	228	205	221	176	277	201	1,308	25¼	12	1	10
H. L. Abrook : White Leghorns	218	163	249	241	233	184	1,288	25⅛	12	9	5
M. C. Byrne : White Leghorns	200	206	231	239	203	196	1,284	24¼	11	7	5
F. A. Bailey : White Leghorns	245	253	219	113	241	212	1,283	26¼	12	1	10
H. Tout : White Leghorns	215	248	226	189	173	217	1,268	26½	11	15	1
J. M. Brooke : White Leghorns	198	248	242	208	220	124*	1,240	26½	11	9	1
G. Cropper : White Leghorns	177*	201	200	243	194	209	1,224	26	11	2	9
G. C. Kennett : White Leghorns	208	174	209	252	212	167	1,222	26¾	11	4	8
R. Whitelaw : White Leghorns	234	210	223	202	139‡	212	1,220	25¼	11	6	3
F. S. Longley : White Leghorns	173	197	225	204	206	204	1,209	27¾	11	5	5
B. Clarke : White Leghorns	175	224	234	238	155*	164	1,190	27	11	2	1
J. Storer, junr. : White Leghorns	153	228	222	192	205	189	1,189	27	10	18	3
T. E. Jarman : White Leghorns	197	207	115*	216	231	166	1,162	26	10	3	3
M. McInnes : White Leghorns	186	199	260*‡	174	146	187	1,152	26¼	10	12	6
G. A. Baxter : White Leghorns	228	143	190	110	255	205	1,131	25¾	10	9	3
A. Windeyer : White Leghorns	114*	184	209	198	223	197	1,125	25	10	18	5
H. S. Morris : White Leghorns	150	254	216	129	191	184	1,124	25	10	4	8
Muranne Poultry Yards : White Leghorns	211	14*	200	237	226	227	1,115	26½	10	9	5
J. Pitt : White Leghorns	210	172	199	133	168	233	1,115	26¾	10	3	3
L. Bulluss : White Leghorns	186	172	236	54	245	213	1,106	26¾	10	6	2
H. J. Cox : White Leghorns	162	178	192	155	206	178	1,071	26½	9	16	2
J. Anderson : White Leghorns	163	204†	218	219‡	118*	144	1,066	25¾	10	2	11
F. M. Lambert : Anconas	172	195	151	152	201	175	1,046	25¼	9	9	11
A. P. Leith : Minorcas	155	143	184	133	163	218	996	26½	8	17	0

* Signifies bird dead, score retained. † Signifies bird replaced, score struck out.
‡ Signifies bird disqualified for prizes on account of eggs being under prescribed weight of 24 oz. per dozen.

Egg-yields of Each Bird and Group in the Nineteenth Annual Competition—*continued.*

Owner and Breed.	Totals of Individual Birds.						Total of Groups.	Weight of Eggs per dozen.	Total Market Value.		
Section B—(Heavy Breeds).											
								oz.	£	s.	d.
J. Wheller: Black Orpingtons	211	216	256	304	299	202	1,488	27½	14	1	10
R. H. Upton: Langshans	319	276	275	258	132	223	1,483	25¼	14	3	0
J. R. Jobling: Black Orpingtons	263	245	246	271	190	233	1,448	25	13	8	3
A. E. Brown: Langshans	292	240	124	225	242	286	1,409	25	13	3	7
C. Judson: Black Orpingtons	251	274	179	231	196	248	1,379	25	12	10	5
P. G. Heath: Black Orpingtons	221	234	285	275	191	211	1,367	25¾	12	18	9
H. Hollibone: Langshans	260	239	220	173	266	207‡	1,365	25¾	13	0	9
J. King: Black Orpingtons	250	271	273	133	226	199	1,352	25½	12	9	3
E. C. Reynolds: Langshans	260	177	203	235	235	242	1,352	25½	12	17	11
J. Every: Langshans	195	192	234	288	225	239†	1,323	25	11	7	6
C. Faulkner: Black Orpingtons	255	181	170	226	224	254	1,310	24½	11	13	9
Hampton and Son: Langshans	209	211	224	197	210	251	1,302	25½	11	7	9
A. H. Moxey: Black Orpingtons	223	161	274	203	221*	215	1,297	26¼	12	7	6
W. Broughton: Langshans	222	280	209	195	185†	203	1,294	26½	11	7	7
J. Roberts: Black Orpingtons	205	232	216	185	221	232	1,291	26	12	5	3
P. F. Miller: Black Orpingtons	200	269	215	94†	259	250	1,287	25½	11	19	10
D. Frew, junr.: Langshans	197	199	251	171	199*	242	1,259	25½	11	6	3
F. J. Shanley: Black Orpingtons	129	208	261	265	183	207	1,253	25¼	11	6	4
O. H. Walton: Black Orpingtons	257	243	159	225	155	204	1,248	26	11	8	9
A. R. Kennedy: Black Orpingtons	257	144*	215	205	217	205	1,243	26	11	13	11
Hillside Poultry Farm: Silver Wyandottes	207	236	238	90	246	225	1,242	25½	11	18	4
A. Campbell: Langshans	218	124	208	206	218	218	1,222	24¾	11	5	5
Herbert Bros.: Black Orpingtons	195	172	239	242	184	186	1,218	26¾	11	2	10
C. Dawson: Black Orpingtons	201	196	235	230	209	146‡	1,217	25¼	11	4	4
C. H. Gerrard: Black Orpingtons	152†	236	186	263	192	184‡	1,213	25½	11	3	4
L. Graham: Black Orpingtons	166	174	240	231	215	186	1,212	25½	11	4	0
D. Kenway: Black Orpingtons	170*	229	214	216†	182	189	1,209	26¼	11	7	6
F. J. Morrison: Black Orpingtons	223	198	188	142	213	244	1,208	25½	11	8	3
A. Collier: Langshans	215	214	192	76	214	296	1,207	26¾	12	0	3
W. E. Webster: Black Orpingtons	233	246	216	214	134	156	1,199	25¼	11	4	7
A. Hughes: Black Orpingtons	254	240	253	97	216	124*	1,184	24¾	11	5	1
H. A. Gradwell: Black Orpingtons	249	190	190	166	179	164	1,138	25¾	10	11	10
G. Gurney: Langshans	187	151	224	221	141	204	1,128	25	10	7	6
Hambly and Wales: Black Orpingtons	247	210	119	148	260	139	1,123	26½	10	14	2
C. Ray: Black Orpingtons	227	158	180	189‡	220	149	1,123	24½	10	8	3
Grasmere Poultry Farm: Black Orpingtons	249	257	241	56	180†	135	1,118	25	10	12	9
G. Jobling: Black Orpingtons	196	215	166	149	215	177‡	1,118	24¼	10	8	10
Alcorn Bros.: Black Orpingtons	234	118	171	145‡	241‡	193	1,105	24½	10	7	10
Mrs. R. Hedges: Black Orpingtons	180	155	153	167	194	256	1,105	24½	10	8	6
H. W. T. Hambly: Black Orpingtons	225	128	177	216	169	184*	1,099	26¼	9	19	3
F. S. Horner: Black Orpingtons	180‡	253	256‡	208	192	..*	1,089	23¾‡	10	7	3
J. D. Martin: Plymouth Rocks	209	207‡	130	205	209	116	1,076	25¼	9	19	2
R. S. Muir: Silver Wyandottes	205	206‡	91*	207	178	187‡	1,074	23¾‡	10	5	9
W. H. Forsyth: Silver Wyandottes	188	174‡	126	245	133	205	1,071	25½	10	0	10
A. Chick: Black Orpingtons	116	99	230	216	161	237	1,059	26	9	15	6
B. A. Maher: Black Orpingtons	243	61‡*	237	160	127	132	960	24¼	9	3	3
W. H. Whittorn: Black Orpingtons	223	222	123	254	61*	172	955	24½	9	0	5
Section C1—Standard Section (Light Breeds).											
C. McKendry: White Leghorns	226	255	260	231	241	212	1,425	26½	13	7	8
A. Messervy: White Leghorns	160	199	182	229	234	199	1,203	25¼	11	2	8
E. J. Clarke: White Leghorns	242	180	177	227	209	114	1,149	27¼	10	13	2
R. R. Brown: White Leghorns	176	187	195	202	178	196	1,134	27¾	10	7	9
C. A. Clarke: Minorcas	153	158	148	168	161	156	944	30½	8	9	1
Section C2—Standard Section (Heavy Breeds).											
W. Townsend: Langshans	192	240	256	217	226	177	1,298	25¼	12	4	8
F. M. Weierter: Silver Wyandottes	147‡*	264	197	220	187	182‡	1,193	23½‡	11	5	8
J. Waterhouse: Rhode Island Reds	218	228	175	179	181	195	1,176	26¾	10	18	6
J. H. Madrers: Rhode Island Reds	204	208	147	177‡	203	155†	1,094	25¼	10	4	9
J. Page: Plymouth Rocks	182	101	186	178	203	170	1,020	26¼	8	19	8

* Signifies bird dead, score retained. † Signifies bird replaced, score struck out.

‡ Signifies bird disqualified for prizes on account of eggs being under prescribed weight of 24 oz. per dozen.

A Garden Fly Maggot.

(*Bibio imitator* Walker.)

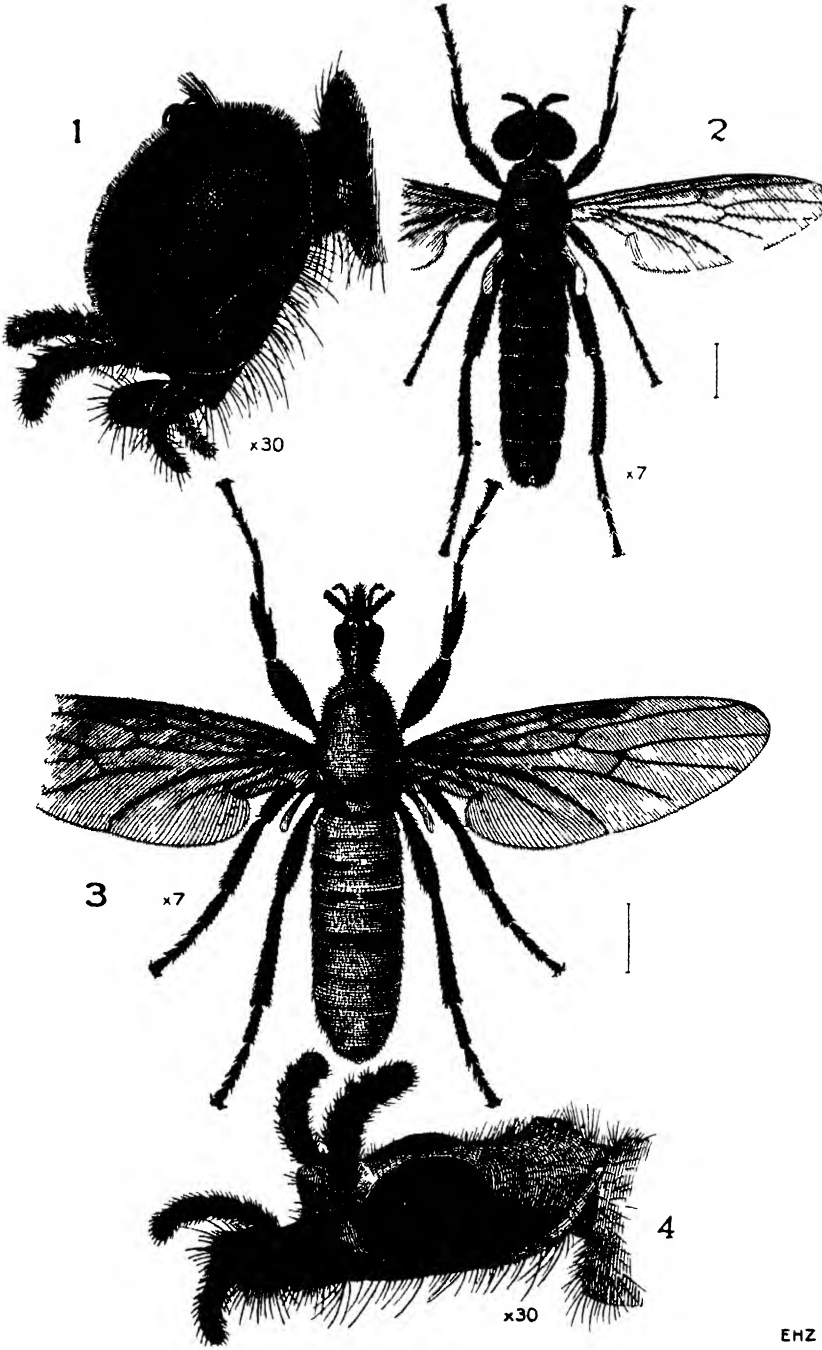
W. W. FROGGATT, F.L.S., Government Entomologist.

THE members of the family *Bibionidæ* are all small flies, with slender bodies and dark coloured wings; they seldom exceed half an inch in length, and in most cases are much smaller. The curious structure of the head is shown in the illustration, and the remarkable difference in colouration and form of the male and female of the same species is very characteristic of the group. The species now under consideration used to be very plentiful in the early summer in the valleys of Rose and Double Bays upon the flowers of the native shrub *Astroctria floccosa* before the ground was cleared for building purposes. *Bibio imitator* was described by Walker in the *Entomological Magazine* in 1835. Skuse, in his work, "Diptera of Australia" (*Proceedings of the Linnean Society of New South Wales*, 1888), re-describes both the male and female, and lists two other species.

The male measures about 10 mm. in length from the front of the head to the tip of the wings, and is of a uniform black colour with the under surface of the head, the upper surface of the thorax, and the legs fringed with rusty brown hairs. The female is slightly longer and much more robust than the male, with the head produced in front. The centre of the head is dull red, the rest black; the thorax and the base of the wings are bright reddish brown, the wings smoky-brown, the legs blackish, clothed with dark-coloured hairs, and the abdomen reddish brown and thickly covered with fine reddish hairs.

These flies usually select a patch of loose garden soil containing leaf-mould or humus in which to deposit their eggs. The resultant maggots often mass together in the earth in hundreds, and when full-fed pupate just beneath the surface. Specimens received from a garden near Mosman pupated, and the perfect flies emerged in the breeding jars in the last week of October.

The legless maggots are of a uniform, dull-brown tint, cylindrical in form, with rounded head and well-defined segments in the body, with a few scattered hairs on the sides and tip. They measure about half an inch in length. Persons finding them swarming in the garden soil naturally imagine that they will damage the plants, but as far as the evidence goes they obtain their food from the humus in the soil, and do not molest the roots of the surrounding plants; the larvæ of other species of the family, however, are known to feed on grass roots. Williston, in his "North American Diptera," says that very little is known about the life history of these flies, and remarks: "Such larvæ as are known are cylindical, footless, with transverse rows of bristles, usually with eyes; they feed upon excrementions or vegetable substances, especially upon the roots of grass."



A Garden Fly Maggot (*Bibio imitator*, Walker)

1.—Side view of head of male. 2.—Dorsal view of male. 3.—Dorsal view of female. 4.—Side view of head of female.

Progress Reports on Farmers' Grass Plots.

Progress reports have been received from two farmers who are growing various grasses on farmers' experiment plots. A few extracts will, perhaps, be interesting.

Mr. A. Short, Dorrigo, on whose farm the plots were sown during the drought, with the result that it was feared they would be a failure, writes on 7th February :—"The grass plots did not turn out too badly after all—at any rate they were far from a failure. We kept them practically free from weeds, and allowed no stock to graze them off, and now we have taken off some prime *Phalaris bulbosa*, rye, and fescue seed. The rye was allowed to seed before, and it is now germinating all over the plot. The *Phalaris* plot was admired by everyone who saw it. Of course, with the exception of the rye, the plots were on the thin side, but they grew well, and I took the following measurements :—Spineless burr trefoil, 3 feet 6 inches; *Phalaris*, 6 feet; cocksfoot, 5 feet; giant fescue, 6 feet; sheep's burnett, 3 feet; red clover, 3 feet 6 inches; red top grass, 3 feet 6 inches; alsike clover, 2 feet 6 inches; perennial rye grass, 5 feet 4 inches. All these grasses undoubtedly do well here."

On the farm of Mr. J. Beasley, Hargreaves, *via* Mudgee, several native and introduced grasses and clovers were sown in November on very light soil. Bokhara clover is now (early in February) 2 feet high, stooling well, and standing the dry conditions remarkably well. Kikuyu grass (*Pennisetum longistylum*) is well established and very green, and some runners are 2 feet to 3 feet long. Giant fescue grass is 1 foot high, very vigorous, but slightly inferior to Hooker's fescue. *Phalaris bulbosa* is 6 inches high; although slower than most of the other grasses, it is succulent and green and very promising. Cocksfoot and ryegrass are badly affected by the hot dry weather prevailing.

All the native grasses sown at this farm germinated well. Amongst the most promising are the following :—Hooker's fescue (decidedly drought resistant, and showing good growth under cold conditions), Coolah grass (a rapid grower, now 2 feet high, and in flower, and well liked by neighbouring farmers). Queensland blue grass (about 1 foot high and in flower, though not so vigorous as Coolah grass), and wallaby or white top grass (about 6 inches high, very slow growing at present, but likely to push ahead in the autumn).—E. Breakwell, Agrostologist.

Better Stock Movements in U.S.A.

That there is widespread public interest in live-stock improvement is shown by the support accorded such activities as cow-testing associations, poultry culling, and the "Better sires—Better Stock" campaign and similar movements of the United States Department of Agriculture. On 30th June, 1920, cow-testing associations numbered 467, a gain of 87 over the corresponding date in 1919. Bull associations increased during the same period from 78 to 120.

The "Better Sires—Better Stock" campaign, planned to bring about improvements in the average quality of all classes of live stock, has been well received. On 30th June, records show, 2,078 persons (owning approximately 232,322 head of stock) had pledged themselves to use only pure-bred sires and to follow methods of breeding leading to live-stock improvement.—*Weekly News Letter* of U.S.A. Department of Agriculture.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture now publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of wheat, oats, maize, sorghum, Sudan grass, potatoes, and other crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

This list is compiled after inspection of the seed and report by a field officer of the Department (preferably during the growth of the crop), and farmers who have pure high-class seed of good quality of any variety of farm crop are therefore invited to communicate with the Under Secretary and Director, Department of Agriculture, Sydney.

The Department does not undertake to buy any of the seed, but recommends the grower by publishing his name in this list. The following list indicates where pure seed, recommended by the Department, is at present obtainable:—

Wheat:—

Billy Hughes	Manager, Experiment Farm, Condobolin.
Bomen	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	H. M. Hall and Sons, Studbrook, Cunningar.
Canberra...	S. M. Haig, Lisburn, Wombat.
	H. K. Nock, Nelungaloo.
	E. J. Allen, Gregra.
	R. J. O. Berryman, Aniemoore, Botfield's Siding.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
Clarendon	Manager, Experiment Farm, Condobolin.
Cleveland	W. Burns, Goongirwarrie, Carcoar.
	Manager, Experiment Farm, Bathurst.
College Purple	Manager, Experiment Farm, Temora.
Comeback	Manager, Experiment Farm, Temora.
Currawa	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Federation	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Bathurst.
	H. M. Hall and Sons, Studbrook, Cunningar.
Firbank	Manager, Experiment Farm, Nyngan.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
Florence...	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Condobolin.
Genoa	Manager, Experiment Farm, Glen Innes.
Gresley	Manager, Experiment Farm, Temora.
Hard Federation	E. J. Allen, Gregra.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Condobolin.
Improved Steinwedel	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
King's Red	Manager, Experiment Farm, Temora.
King's White	Manager, Experiment Farm, Temora.
Marshall's No. 3	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Cowra.

Systematised Poultry Farming.

Systematised poultry farming requires a fair amount of capital to start, and this is not always available to the farmer. How far our Group Soldier Settlements, where good housing and equipment is a special feature, will point the way to civilian settlement on better lines than obtain at present on the great majority of farms, remains to be seen. Much depends upon the individual soldier-settler as to what bearing these settlements will have upon systematised poultry farming, and also how far they will have the confidence and respect of investors and institutions, in whose power it lies to assist the industry very materially. It may even be that the effect will be to lift it on to a sound commercial basis.

The System Advocated.

We may commence with the chickens taken into the brooder-house or given to hens, as the case may be.

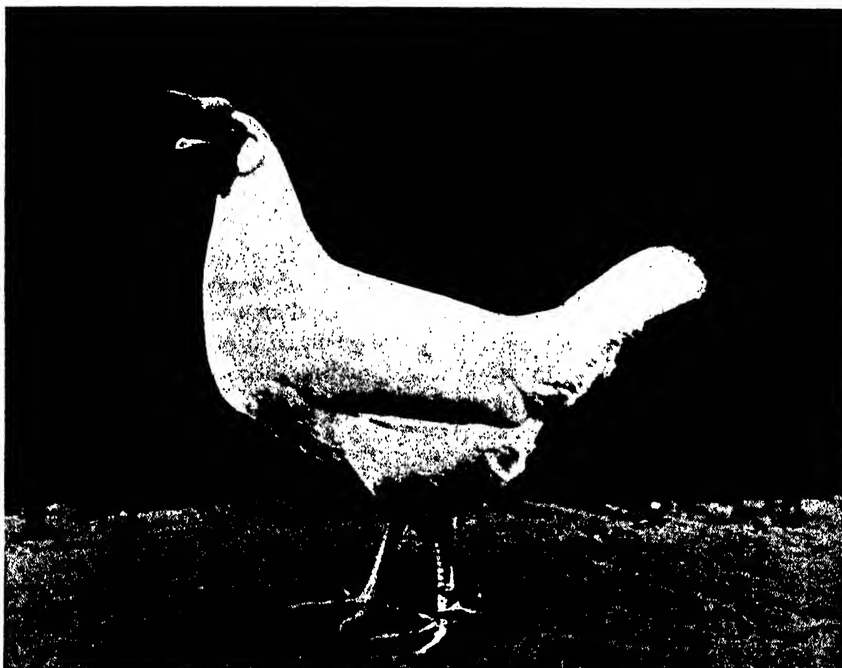
The chickens remain under brooding conditions for six weeks. They are then transferred to the rearing section, which is preferably constructed on the continuous-shed principle, divided into 8 feet or 7 feet compartments; fifty to seventy-six chickens are housed in each. They remain there until 10 or 12 weeks old. From there they are transferred to the colony system, which consists of a number of houses, each accommodating fifty birds, situated in extensive enclosures. They remain there until the pullets are coming on to lay and the cockerels are sold, or, where stud business is done, are transferred to the cockerel pens. The advantage of this system is that the growing stock, from 10 or 12 weeks old, as above, have practically free-range conditions, which ensures, other things being right, very much better development than is possible with growing stock confined to small and often bare yards. It follows that separate enclosures are necessary for each sex; and also at least two enclosures, for the different ages in the males. It is all the better if the same thing can be arranged for the pullets. While the dividing up into different ages is not so necessary in the later stages of rearing as in the earlier, it is still advisable where possible. The question is often asked, if, say, 300 or 400 can be run together in a single enclosure, why not in a single house, or say, two houses? Experience shows the difference in results to be very material. It should be understood that nearly all the serious troubles incidental to growing stock arise from the large aggregations in their camping quarters, and not when they are out in the open.

It might be pointed out that in regard to mature stock the same danger of serious disease does not exist. Hence it comes about that we can safely house mature stock in flocks of 100 to 200 or even more, whereas this same class of housing is more or less fatal to the young, which are more susceptible to all diseases of an epidemic character. Poultry-farmers desiring to see this system in operation might pay a visit either to the Hawkesbury Agricultural College, Richmond, or to the Grantham Stud Poultry Farm, Seven Hills, where it is carried out in its entirety and with the most satisfactory results.

Faulty Housing.

The proper housing of poultry is at present a very expensive item, and as described as part of the system it is not within the means of all that come into the industry. Nevertheless one frequently sees money and energy wasted on the construction of poultry buildings that, with a better knowledge of essentials on the part of the farmer, might have been more wisely and effectively spent.

In this connection there are three outstanding faults that can be avoided —in most cases without additional expenditure, and in others with the same outlay or even with less. In other words, many of the defects seen are the result of ideas not based upon sound experience.



White Leghorn Hen (a good laying type).

One of the worst faults in construction is low buildings. It stands to reason that a high building is more airy and hygienic than a low one. Low poultry houses are unhealthy, and therefore must result in lowering the vitality of the birds, and this, in turn, has a detrimental effect upon both development in the young and upon the egg-production of the more mature birds. When one considers that a poultry house is, for all practical purposes, composed of three walls (the back and two ends, with a roof) and that the latter is by far the most expensive portion of the building, there appears little wisdom in saving a few shillings in the height of the walls at the expense of hygiene; not only so, but on the score of economy of space more birds can

be safely housed in a high building than a low one with the same floor space Therefore there is, generally speaking, no economy in low buildings.

The next most notably bad feature in poultry-house construction is in regard to depth as compared with width. Adult poultry houses in our climate are practically all on the open-front plan, but many are built with less frontage than depth from back to front. This is a grave error. The roosting portion in the back of such houses is stuffy, and one has only to go into them at night when the birds are all at roost to realise the extent to which this is the case, and to discover how vitiated is the air which the birds have to breathe.

In all houses the length of the open front should be much greater than the depth, and particularly so in houses over 6 feet in depth. To use an illustration, houses 14 feet wide or over, should be nearly double that measurement along the open front. The writer has seen poultry houses with a 6 feet to 8 feet frontage with a depth of nearly double that measurement. The reverse should be the case. When poultry-farmers realise the extent of the troubles arising from such defects in construction and the losses both in birds and eggs which result therefrom, a big advance will have been made in essentials to commercial poultry farming.

A Typical Hen.

In regard to the accompanying illustration of a good type of White Leghorn hen, it may be admitted that one would not expect to find all the birds on any farm as symmetrical as this, but if breeding for type and character is kept steadily in view in the matings, the poultry farmer will soon find a wonderful improvement in his flocks.

Co-operation.

Co-operation is a golden mean between individualism and socialism. It includes all the good features of both. On the one hand it demands and develops individual initiative and self-reliance, makes the rewards of the individual depend upon his own efforts and efficiency, and gives him full ownership of specific pieces of property. On the other hand, it compels him to submerge much of the selfishness and indifference to the welfare of his fellows which characterises our individual economy. It embraces all the good that is claimed for Socialism, because it induces men to consider and to work earnestly for the common good, eliminates much of the waste of competitive industry, reduces and redistributes the burdens of profits and interests, and puts the workers in control of capital and industry. At the same time it avoids the evils of industrial despotism, or bureaucratic inefficiency, of individual indifference, and of an all-pervading ownership.—Dr. J. A. Ryan.

Orchard Notes.

MAY.

W. J. ALLEN and W. LE GAY BRERETON.

THE packing season, even in the later apple districts, will now be drawing to a close, and the orchardist will be turning his thoughts again to pruning. Before doing so, however, he should first straighten up his packing shed. Keeping varieties that he has decided to hold should be sorted, and only those retained which are free from blemishes that will impair their keeping. Such stored fruit should be stacked so that those it is intended to put on the market first are nearest the front, and the whole of the stack will come in proper rotation ; the effect will be to minimise the time in handling as far as possible.

It should be remembered that the holding and handling of such fruit during the winter cuts into the time reserved for other main operations, and it is not uncommon to see the whole of the winter and spring work behind-hand, chiefly through this cause. Everything, therefore, should be done to systematise the late handling of fruit, and avoid, as far as possible, the holding up of the regular winter and spring orchard work.

In districts where the industry is sufficiently concentrated to warrant a central cool store, this difficulty is overcome, and the fruit will still be practically under the holder's eye, and he can have it placed on the market as he wishes.

Before leaving the packing shed for the season, there should be a general clean up, and any decaying or other worthless fruit should be destroyed, sound, clean cases stacked away, returned cases or others that have held infected fruit dipped before stacking, damaged cases stacked separately ready for repairing on wet days, all sacking used on the packing benches dipped (in order to kill any larvæ of pests that may be sheltering between the folds of same), and the wood-work of all such benches, packing stands, &c., thoroughly scrubbed down, and examined for any grubs that may be hiding.

Of course, much of this work can wait till wet days during the winter when the regular work is held up, but it should be carried out before the larvæ again become active in the spring.

In May, peach and other stone fruit trees will have dropped their foliage in most districts, and if a grower has much pruning to get through, it is wise to make a start on this class of tree, so that he can get most of the pruning through before it is time to start the winter spraying and ploughing. By dealing first with the trees that start first in the spring, leaving the late starters till last, one gets the full length of the season to operate in.

Full information is given on pruning the various fruit trees in "Pruning," issued by this Department. A new edition is in the press, and should be obtainable quite early from the Government Printer, Sydney. Price, 3s. 2d., post free.

Planting.

It is not too late to plough and subsoil land for planting deciduous trees this season, but the sooner this work is carried out the better, as previously pointed out in these notes.

A few years ago there was considerable discussion as to the advantage or not of subsoiling. No doubt much depends on the soil and climate, but the following report in the April number of *The Fruit World* on an experiment carried out by the South Australian Department of Agriculture is interesting :—

"There is a tillage test in progress, its object being to compare the value of two ploughings per year as against one, and also the effect of subsoiling against the ordinary six-inch ploughing before planting the trees. This plot was set out in 1909, and until the drought year (1914) all the trees appeared to thrive equally well, but evidently the shallower rooted hole on the non-subsoiled area told its tale at that stage, and since then the quality of the fruit and growth of the trees show considerable difference when compared with those on the subsoiled area."

Pests.

Now that the bulk of the harvesting is over, one can give attention to such pests as woolly aphis, which, during the busy time of the fruit season, generally makes headway. As soon as the foliage begins to fall, the trees should receive a thorough spraying. It is necessary to use high pressure, and hold the nozzle close to all affected parts, which on large trees use a lot of spray, most of which eventually collects around the butt of the tree; hence, for this cleaning up, use a tobacco wash in preference to one of the oil sprays. During the winter, codlin moths are often driven from exposed resting places to more secure ones, and it is wise to keep the bandages on apple and pear trees, and to examine them late in winter.

The Losses Due to Animal Diseases.

Every year the people of the United States lose over 200,000,000 dollars directly (and no one knows how much indirectly) through diseases of farm animals. This is a large toll when divided on a per capita basis, and when it comes home to the farm stock-raiser who finds a valuable animal dead in the barn, or an epidemic spreading ruin into his herd, the loss is sometimes disastrous. The most regrettable feature of the case is that probably three-fourths of the loss could be prevented.—*Weekly News Letter* of the U.S.A. Department of Agriculture.

Agricultural Bureau of New South Wales.

DEMONSTRATION HIVE FOR BEE-KEEPERS.

ARRANGEMENTS have been made for the loan to branches of the Agricultural Bureau of a complete hive, together with samples of bee-keeping material, with the object of enabling members interested in the subject to see the correct way of fixing the supers, &c. In addition to the hive, the collection comprises super frames, foundation comb, mailing cage for queens, &c. Full information will accompany the package. Applications (which should be addressed to the Under Secretary and Director, Department of Agriculture, Sydney) will be dealt with in the order in which they come to hand, and the material will be sent from one branch to another, the receiving branch in each case being asked to pay the small amount of the freight.

REPORTS AND NOTICES FROM BRANCHES.

NOTE.—While gladly publishing in these columns the views of members of the various Branches of the Agricultural Bureau, the Department does not necessarily endorse the opinions expressed.

Adamstown.

At a meeting of this branch, on 17th March, Mr. C. Crowther addressed the members on the budding and grafting of fruit trees. Mr. E. B. McPherson also made useful suggestions in the course of the discussion that followed.

Auburn.

The members met on 12th March, when Mr. Secombe, of Canley Vale, gave an address on the subject of strawberry culture, which he covered most carefully.

The exhibit of vegetables was a good one, several non-competitive specimens of maize being brought forward. Several members made their first exhibits, and the display altogether was a most interesting one.

Borenore.

A meeting was held on 26th March, when the question of co-operative buying was discussed, and arrangements made for any members who wished to secure goods in that way to do so. The members intend to purchase large consignments through the medium of the branch, and to thus save a good deal of expense.

Canley Vale.

A member of this branch gave a lecture on Muscovy ducks at a meeting on 18th instant.

The chief points touched on were the selection for breeding purposes of well-developed birds, comfortable housing, and sand floors. The birds should be allowed to build their

own nests. They should not be forced to lay, but should be fed on plenty of greenstuff, and the water should be kept fresh, and deep enough to cover their heads. It was advisable to separate the ducklings from the ducks at once, but to put them in a cosy place, not allowing them to get wet, and always having a dry place for them to go into. Lime should not be put in the yards, as it burnt the web of their feet, and no light should be taken near them at night, or they would rush to the light and trample one another. If the water supply ran out, they should be fed before being given a drink, or death would result. Plenty of shade should be provided. Drakes should be marketed when fifteen weeks old, and ducks when twelve weeks old. Ducks should be separated from drakes as soon as possible, and not given either too much free range or too much bathing.

DEPARTMENTAL NOTE.—The Poultry Expert remarks that while it is desirable to feed succulent greenstuff to ducks, it should be fed rather as an adjunct. The best results cannot be obtained by feeding large quantities of greenstuff. Like the hen, the duck has not a capacity for dealing with a large percentage of roughage, and the food should principally consist of more concentrated material. The paper otherwise contained sound advice.

Castlereagh (via Penrith).

On 24th January, Mr. Breakwell lectured before this branch on pasture grasses. The native grasses were first dealt with, valuable ones and the methods of encouraging their increase being indicated. The principal introduced grasses were also described, and their utility to the district pointed out. The value of lucerne was mentioned, and also the results obtained by winter top-dressing with superphosphate.

Cordeaux-Goondarin.

The monthly meeting was held on 25th February, when general business was dealt with.

On 3rd March Mr. A. A. Ramsay delivered a lecture on common fertilisers, and on 8th and 9th March Mr. W. le G. Brereton gave a demonstration of packing fruit.

Dapto.

At a meeting on 10th March Mr. W. L. Hindmarsh, B.V.Sc., M.R.C.V.S., veterinary officer of the Stock Branch, delivered a lecture on contagious diseases of cattle, especially contagious abortion, mammitis, and ophthalmia. The information given was valuable, and its presentation interesting to all hearers.

A sample of Sudan grass, grown by Mr. R. C. Johnston on his own farm without manure, was exhibited. It had come into head at a height of about 8 feet 6 inches in about two and a half months.

Glenfield.

On 15th March Mr. R. Sanders read a paper on rose culture, illustrating it by means of drawings on the school blackboard. A summary of the paper follows:—

ROSE CULTURE.

When you have selected your bed, it is best to trench the ground 18 inches deep, keeping the top soil on the top. This can be done by removing the top soil from the first trench and wheeling it to where it is intended to finish. Then break the bottom soil thoroughly with a fork. This will need care in starting, otherwise the fork-handle will be broken; but after the first trench is done it will be quite easy. Next, take the

soil from the top of the next trench and throw it on top of the clay in the first trench; then break the clay bottom so exposed, and continue until the bed is finished. At the last trench, break the clay and then turn in the soil wheeled from the first trench.

It is better, if possible, to put in a drain to carry off any water from the bottom of the trench. The surface must be kept level. Manure may be worked in while trenching, or spread afterwards and forked in deep enough to ensure that it will not come in contact with the newly-planted roots.

The bed is now ready for the planting. Roses should be planted 3 feet apart and 4 feet between rows. A good way to plant is on the septuple system.

Open up the holes 6 or 7 inches deep, spread the roots of the plant, and sprinkle about 3 inches of soil over them. Then tread firmly, give a good watering, and, when the water has drained away, fill in the holes. From March till June is the best time to plant, and by October the results should be splendid.

July and August is the best time to prune; but roses planted this year will need no pruning until next year.

The above is the method of culture in stiff soil. It is not necessary to trench sandy soil, but it will need to be more heavily manured than stiff soil. Roses on their own roots do better than plants budded in sand, as the briar does not like the sand too well. The tea and the hybrid tea roses are the most useful types to grow.

Inverell.

At the March meeting arrangements were advanced for a district conference of delegates from branches of the Agricultural Bureau, the date proposed being 27th April. Other general business was also dealt with.

Mr. R. L. Campbell is dealing with the subject of book-keeping for farmers, covering it in a simple but ample manner. At the above meeting the second portion of his paper was read.

Kellyville.

A meeting of this branch was held on 12th March, when general business was transacted.

Middle Dural.

At a meeting on 12th March a proposal that blackthorn should be declared a noxious weed was discussed at some length, and the district executive of the Fruitgrowers' Association was requested to oppose the proposal on the grounds that a vast number of scrub and ornamental trees were also affected by white wax scale, and if the blackthorn was declared to be a noxious weed, then every tree in the bush would have to come under the same heading.

Members discussed their experiences this season in the spraying of citrus trees. The majority of growers who had used the formula given some months ago (20 lb. soda, 1 gallon red oil, 40 gallons water), had had remarkable results.

Milbrulong.

A meeting was held on 28th February, when the co-operative store movement was further discussed. It was pointed out that in October over 3,000 shares were promised, but now owing to the non-receipt of the 7s. 6d. per bushel for wheat a lot of promises were being withdrawn, making it more difficult to start the store. It was agreed to allow this part of the scheme to lapse, but to continue the bulk-buying scheme. Hitherto these goods had been received by a resident of the town, who stored them on his property

until the members called for them. Lately, however, the quantity of goods has become too large to be handled in this way, and it is proposed to purchase a section and build a store-room in the town, the movement to be financed by the issue of shares. The matter was left in the hands of the directors to obtain estimates as to the cost.

The total amount of purchases at the October meeting was £1,472 17s. 8d., the largest order so far placed. A credit balance of £2 10s. 11d. was shown over this order meeting.

An order meeting was held on 3rd March, when it was observed in reading out the prices that nearly all farm requirements were declining.

Milton.

A meeting was held on 8th March, when Mr. A. Brooks, Works Overseer of the Department, gave an address on the construction of silos.

The Construction of Silos.

Mr. Brooks remarked on the need of the dairy-farmer for conserved fodder, and that the scheme that cost the least money was the one that farmers were looking for. The Department of Agriculture wanted to help the farmer who was prepared to help himself.

In silo construction the circular type was always to be recommended as being the most easily and effectively packed. The corners in rectangular silos were hard to pack and caused waste. If circular silos were not used, he would strongly recommend the octagonal or sixteen-sided. In fact, it would be found that if concrete was being used these would be easier shapes to build than circular, as the necessary forms or moulds were more cheaply and easily constructed—an important consideration—while the quality of the silage was much the same.

As to materials, wood gave by far the best silage, and if it were kept painted and well looked after, it would last for fifty years or more; indeed, its life was indefinite. Oregon pine had been used principally, but Australian timbers, if properly seasoned, were just as good. Seasoned timber was very hard to get, however, and Mr. Brooks indicated that Australian timber could be used, by erecting the walls of the silo only the first year; using the silo in that form for one year, and then the following year, when the timbers were thoroughly dried or seasoned, the structure could be taken down and re-erected with close joints. The result would be a silo that would last as long as any.

If concrete were decided upon, great care should be taken in mixing the materials thoroughly, for this was important in all concrete work. The dry materials should be mixed on a good timber floor, 9 ft. x 10 ft., and turned several times, after which the mixture should be made somewhat sloppy and fed into the frames as quickly as possible before it had time to commence to set.

For those who were not using solid walls he would recommend hollow concrete bricks, which could be made in the farmer's spare time in a simple frame made for the purpose.

Where several farmers in a neighbourhood were considering the erection of silos, he would recommend the farmers to get together and decide how many were to be built and in what order. They could then club together, get a set of moulds, and engage a competent builder to erect the silos in the order agreed upon. The builder would erect one silo in every three weeks and he could go from one farm to another taking the moulds with him. A set of moulds would keep in repair as long as they were in use, but if a farmer made or bought a set of moulds, erected a silo, and then a year later wished to lend the moulds to a friend, he would find that the whole of them had deteriorated.

In either case, however, it was necessary to let the silo dry well before commencing to fill it. The silo should be of 100 tons capacity for a farmer of 40 cows; this would be 16 feet in diameter and 25 feet high; 5 feet of the height, he recommended, should be in the ground.

Other types of silos were also discussed, such as pit, hillside, and stack silos, but none of them were worth the expenditure compared with the tub.

Informal discussion, and very interesting to the farmers of the district, took place. It is hoped that one result of the meeting will be more silos in this part of the coast next year. Mr. Brooks was cordially thanked for a valuable address.

Oberon.

On 10th March, Messrs. E. A. Humphries, W. Franklin, and F. Wilson read papers before this branch on pea growing.

Pea Growing.

Mr. Humphries considered the soil and climate at Oberon eminently suitable for pea-growing. The first consideration was the seed, which should have a green appearance. The depth of planting varied according to the season. If wet it should be shallow, but if dry from 4 to 6 inches below the surface. The ground should be in a loose condition.

Yorkshire Hero was the heaviest yielder, but it brought a smaller price than other varieties, such as American Wonder and Richard Seddon, which kept their colour better. Yorkshire Hero dried very quickly.

In rich black soil the stalks grew very high, 3 feet to 4 feet, but they fell over and the peas underneath did not mature. The red soil hills, where the ground was loose, gave the best results.

Scarifying was good, it kept the ground loose ; and tilling was also beneficial, the loose soil thrown in on the roots acting as a mulch. He had conducted experiments for himself with fertilisers, and had had good results from a special pea fertiliser, and also from superphosphate alone. The mixed pea fertiliser had given 9¾ buckets from two rows and the superphosphate 9 buckets ; and in another test the mixed fertiliser had given 10¾ buckets and the superphosphate 10¼ buckets. From two unmanured rows he only got 3¼ buckets. The superphosphate cost £6 10s. per ton, and the mixed fertiliser £12 per ton. The manure agents informed him that the use of the mixed fertiliser would save him the expense of liming the land. He used 180 lb. of manure per acre ; last year he had put on 2 cwt.

If land was used for peas more than twice, it became "pea-sick." A good rotation for this crop was oats. He used 1½ bushels of seed per acre of Yorkshire Hero, it being a large variety. Of other varieties he used 1¼ bushels.

When picked the peas were spread out 3 to 4 inches deep on a floor to prevent sweating in the bags. He had also allowed 3 to 4 buckets to stand in a chaff-bag in a cool place where the wind could get at them, making a hollow in the middle of the bag.

The average price obtained was from 6s. to 18s. a bushel, but he had received only 4s. when peas were too ripe. American Wonder brought the highest price.

He had planted peas every four days ; but, owing to the weather, he found that peas planted at a difference of a fortnight in time ripened all together.

Mr. Frank Wilson described his soil as from poor to medium. He used 2 cwt. of superphosphate to the acre. The first year he obtained 16s. and 17s. per bushel for Stratagem, and 14s. for Yorkshire Hero.

His second year was a failure, as he only gathered 107 bushels from 3 acres ; but in his third year he had obtained 100 bushels to the acre.

He had tried a quarter of a bushel of Dwarf Champion. It had a short stalk, yielded better than Yorkshire Hero, and brought 2s. per bushel more. He had tried Richard Seddon, English Wonder, and Senator, and found them all much alike. Their colour was a darker green, and they always brought 2s. per bushel more.

He had picked out a few pods of Yorkshire Hero, which looked better than others, and planted them by themselves in two rows 8 inches apart, and the seeds 2 inches apart. He used superphosphate, and picked 1 lb. of peas from every yard of the rows.

Mr. W. Franklin said he had planted new ground 50 yards square. The seed was planted 8 inches deep and no manure was used. He used three-quarters of a bushel of Yorkshire Hero seed and picked 98 bushels. He had saved the seed himself and considered that growers should confine themselves to the amount they could pick by themselves. He promised to give further particulars as to the yield of different plots at the next meeting.

Departmental Note.—The Chief Inspector of Agriculture remarks, with regard to the above, that the experiments these growers have been conducting are sure to bring about a considerable improvement in yields, and are therefore valuable to all. It will be found well to ascertain, as nearly as possible, the monetary value of any increase obtained. The results in the fertiliser trial, for instance, indicate that an appreciable saving can be effected by the use of the right fertiliser. If lime is required, the purchase of it in the form of a special fertiliser is very costly, for it can usually be purchased at about £2 per

ton on rail. The fertiliser required depends upon the nature of the soil, and farmers can save themselves considerable expense by ascertaining by tests what is required, and making up for themselves any mixtures they find necessary.

It is satisfactory to note, too, that some growers are taking steps to select their own seed. We depend too largely upon imported seed, and the valuable varieties of wheat and other such crops that have been obtained by local selection and breeding give ground for believing that similar results can be obtained in the case of other crops. Growers should always be on the alert for superior plants, as yield depends very largely upon the seed sown.

Rydal.

The veterinary officers of the Stock Branch, in connection with a paper published last month, point out that tuberculosis is more common in pigs than the writer perhaps thinks. As a matter of fact it is very common, and is associated with the incidence of tuberculosis in cattle. Animals may be, and often are, affected for a very long time (even up to years), and are capable all the while of infecting other animals. The veterinary officers add that the amount of tuberculosis in pigs could be greatly decreased if the following measures were carried out regularly and thoroughly:—(1) Cleanliness in feeding and housing; (2) boiling all milk and meat products before feeding to pigs; (3) not allowing pigs to graze over land on which cows are running, unless the latter are known to be free from disease; and (4) inspections of milking cows and breeding sows by veterinary surgeons and stock and dairy inspectors.

Springside.

At a meeting on 22nd February it was decided to alter the yearly period, so that in future it shall cover the calendar year, from January to December. Mr. E. H. Selwood, winner of the recent crop competition, was presented with a suitably inscribed medal.

Stratford.

This branch made an exhibit at the local show of collected produce of different kinds. Contrasts were presented of crops grown under irrigation, and without water, and others with and without fertilizers, so that the value of up-to-date methods of production was plainly illustrated. Various crops, too, that have not been grown extensively in the past, were staged, and created interest. The exhibit was one that is bound to be of value to farmers.

Sydney (Metropolitan).

This new and important branch has been formed in the city under most auspicious circumstances, promises of support being received from many prominent city men with agricultural interests. Sir Joseph Carruthers has been elected Chairman, and Mr. E. Breakwell (Botanic Gardens), Hon. Secretary. Mr. C. Crane, organiser of the Bureau, in an address at the inaugural meeting, expressed his opinion that the new branch would have a distinct and beneficial influence upon all the branches existing in the State. It is hoped that the co-operation of the metropolitan and suburban gardener, fruitgrower, or poultry keeper may be obtained, and that in addition many of the retired farmers, orchardists, pastoralists, &c., resident in Sydney will assist the producer who is still making his way on his property. The result cannot but be for the advancement of rural interests throughout the State.

Toronto.

This branch met on 1st February and again on 1st March. At the latter meeting the balance-sheet of the recent show was submitted by the Secretary. The income was shown to be £42 15s. 6d., and the expenditure £25 10s. 9d., leaving a credit balance of £17 4s. 9d. The result was regarded as highly satisfactory, and the show itself as a great success. It was agreed to contribute £11 to the funds of the Wallsend Hospital.

Wallsend.

The branch met on 15th March, when a discussion took place on the reports of cases of poisoning in stock following feeding with Sudan grass. It was said that all members had grown good crops, and had fed them at various stages without any ill effects, and all were at a loss to understand the cases referred to.

A useful discussion also took place on grasses suitable for permanent pasture in the district. Wallaby and Kangaroo grasses were freely canvassed in the debate.

Warrah Creek.

Members of this branch met on 21st March, when a number of items of general business were dealt with, the branch being able to help in the matters of advising as to the cost of destroying fat-hen, setting aside portion of a recreation reserve for a public hall, fencing the recreation reserve, the establishment of farmers' experiment plots in the district, and so forth. Mr. T. Power read an article on a co-operative sheep dip which was endorsed by all present as a good idea, and Mr. A. Lane presented to the library a book on co-operation.

Wellington.

The monthly meeting was held on 1st March, when Mr. C. J. Kimbell read a paper on sweet peas, following which several questions were asked and produced useful discussion.

Mr. Kimbell preferred evening spraying because the spray then remained longer on the vines as evaporation was not so great at night. Mr. Harvey said he had found that if soot was applied to the soil it was a great aid in colouring the bloom, and with this Mr. Kimbell concurred. Mr. Kimbell had had the best results in germination if sand was placed in the drills.

A general discussion then took place during which Mr. Kimbell pointed out the danger of leaving the earth loose in which a cutting had been placed. He advised the ramming of the earth tightly so as to exclude the air. Mr. Harvey said he had obtained some river loam, with which he worked manure, and in the whole planted some cuttings, but obtained poor results as the cuttings grew for a short period and then died off. At the same time he planted some cuttings in a cask containing ordinary garden soil, with not one failure.

A discussion followed on the subject of grafting, and after it matters in connection with the show came up for attention.

Wentworthville.

On 2nd March, Mr. A. Brooks, Works Overseer of the Department, gave a lecture on the disposal of drainage from the house. The various systems were discussed, and a great deal of useful information was afforded, for which Mr. Brooks was cordially thanked.

On 16th March, Mr. L. S. Rumble delivered a lecture on the making of a cottage garden. He described trenching and draining, and then referred to the manner in which different plants should be used to produce effects in the flower garden. With regard to vegetables, he remarked that most people studied exactly when to sow flower seeds, but seemed to think any time would do for vegetables, whereas it was most important that the different vegetable seeds should be sown at the proper time if the best results were to be obtained.

Yarramalong.

A meeting was held on 19th March, when a number of matters affecting local conveniences, such as local money order facilities, watering places for bullocks in the yoke, and the dangerous state of certain culverts, were dealt with.

Yarrunga-Avoca.

At a meeting on 19th March, business connected with forthcoming lectures was dealt with. Members discussed at some length the increase in the price of manures, which was regarded as of importance to farmers generally.

The demonstration bee-hive has lately been in the use of this branch, and has now been returned to the Hawkesbury Agricultural College.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1921.

Society.	Secretary.	Date.
Wilcannia P., A., and H. Society	E. G. Dolman	May 12
Hawkesbury District A. Association (Windsor)	H. S. Johnston	,, 12, 13, 14
Murrumbidgee P. and A. Association (Wagga)	A. F. D. White	Aug. 23, 24, 25
Corowa P., A., and H. Society	J. D. Fraser	,, 30, 31
Forbes P., A., and H. Association	E. A. Austen	,, 30, 31
Grenfell P., A., and H. Association	G. Cousins	,, 30, 31
Young P. and A. Association	T. A. Tester	Sept. 6, 7, 8
Cowra P., A., and H. Association	E. P. Todhunter	,, 13, 14
Cootamundra A., P., H., & I. Association	C. H. Inson	,, 14, 15
Northern A. Association (Singleton)	J. T. McMahon	,, 15, 16, 17
Temora P., A., H., and I. Association	A. D. Ness	,, 20, 21, 22
Henty P. and A. Society	H. Wehrman	,, 27, 28
Deniliquin P. and A. Society	P. Fagan	,, 28
Narrandera P. and A. Association	W. Canton	Oct. 18, 19
Lismore A. and I. Society	H. Pritchard	Nov. 23, 24

1922.

Society.	Secretary.	Date.
Newcastle A., H., and I. Association	E. J. Dann	Feb. 22 to 25
Glen Innes P. and A. Society	Geo. A. Priest	March 7, 8, 9
Campbelltown A. Society	J. T. Deane	,, 10, 11

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Agricultural Gazette of New South Wales.

The Feeding of Sheep in Times of Drought.

[AT the termination of the 1919-20 drought, circulars were issued by the Stock Branch with a view to the collection of information on the methods of feeding sheep during the preceding months of scarcity. Valuable information was provided by several stock inspectors and others, particularly by Mr. C. J. Woollett, Stock Inspector at Tamworth. From these replies and other sources, the following excellent article has been compiled by Mr. W. L. Hindmarsh, B.V. Sc., D.V.H., one of the Veterinary Officers of the Branch.—S. D. SYMONS, Chief Inspector of Stock.]

THE question of feeding sheep during the periods of drought that occur at intervals in New South Wales is of utmost importance to the grazier. Not only is this necessary in the interests of the individual owner himself, but the losses of individuals affect the economic position of the State as a whole, and it is necessary, from a national point of view, to conserve our flocks and herds to the very best of our ability. It is known by all interested in the animal industry that the breeding stock—particularly lambing ewes—suffer earlier and more severely than the dry stock, and the task of re-building our flocks and herds is rendered the more difficult by that very fact.

With the object of gaining as much information as possible from the men of actual experience in the past drought, the Inspectors of Stock of the various Pastures Protection Districts were last year asked to communicate with the farmers and graziers of their respective districts with a view to learning the following:—

1. How severely the district was affected.
2. Fodders used during the drought.
3. Amounts of feed used during specified periods.
4. Numbers of stock fed.
5. Methods of feeding adopted.
6. Classes of stock fed, especially referring to breeding stock.
7. Approximate daily cost per animal.
8. General results achieved.

It is to be regretted that many who did answer the circulars did not see their way to give definite information, especially regarding the numbers fed, and the average cost per day. Further, in comparatively few cases was it possible to give information regarding definite periods of time during which feeding was carried out. On the whole the main effects of the drought were felt on the country west of the Dividing Range. In few instances were the coast and tablelands seriously affected, and they served to provide agistment for many thousands of sheep from the western plains; certain parts of the coast were without rain, however, especially towards the end of the drought, and there stock suffered in consequence.

In considering a problem of such magnitude the different conditions under which stock are kept in the various districts, the facilities for making or obtaining the fodders at a reasonable cost, and the methods of feeding, are all of importance. In addition, the possibilities of successfully weathering a season of drought depend upon the individual grazier, and the care and attention he is able or willing to devote to his flock. His methods will depend largely on local conditions, and no one method of feeding nor any single class of fodder can receive universal recommendation. At the same time the number of fodders available for hand-feeding is limited to the crops commonly used in the State, and the reports received, though coming from many districts with considerable variation in soil and climate, show a similarity in the fodders adopted. The deciding factors when it comes to the point of actually feeding the flock are—

1. The fodder available.
2. The cost, including transport and labour.

Anticipate Periods of Scarcity.

Before turning to a discussion of the fodders actually used during the recent drought and the methods of feeding them employed, it will be useful, perhaps, to discuss some of the general considerations that enter into the problem. It is possible by the adoption of conservative principles of station management to reduce the risks connected with the business in a very material degree, and among such principles we may particularly mention the avoidance of overstocking, and the improvement of the pastures.

Avoid Overstocking.—This seems commonplace advice, and it is referred to with great regularity whenever stock are suffering from a shortage of food. Actually the problem is more complex than it appears on the surface. In a good season the growth of herbage is so profuse that stock cannot possibly keep it down. It is trampled underfoot and lies in a tangled mass on the ground. Should further rain ensue it rots, and later new herbage grows through it. If it dries it is available as food during the following months, and it is especially valuable if it has seeded well, for sheep will then readily fatten on it. This, of course, does not apply to those grasses which produce the hard pointed seeds that are the source of much harm to the sheep and its wool, although such grasses may provide good feed when in a young stage. It is not to be wondered at, perhaps, that with a profuse supply of natural fodder the grazier is tempted to purchase more sheep, with the idea of fattening them and sending them to market. On the other hand, it is well known that many pastures have been depreciated in value by constant overstocking.

Actually the sheepowner should aim at keeping that number of stock which will enable him at the threat of a dry season to dispose of his wethers and surplus ewes, so that he may have sufficient feed left to carry on with his breeding stock. This must be done before the sheep show signs of loss of condition, and the pastoralist must reckon at the time what sheep he can afford to keep and what will be the probable cost of hand-feeding them.

Even if he is unable to obtain what he considers their market value, it is better to lose a little on their value at once than be put to the worry and expense of finding agistment and feed at famine prices, with the probability that in addition a great number will eventually be lost.

The most valuable stock—those that should be saved—are the young breeding ewes, these being the foundation of the future flock. Hence if it is decided to dispose of any of the stock, the wethers and broken-mouthed ewes should be sold first. Young ewes of fair quality will be valuable after the drought has broken, and will repay the cost of being kept through the bad season.

Permanent Improvement of the Pastures.—The possibility of the pastures of the property being permanently improved should receive consideration. Several factors have affected the carrying capacity of much grazing country in recent years. They are chiefly:—(*a*) drought; (*b*) overstocking; (*c*) admission of sheep travelling from other districts; (*d*) effect of flood waters.

Much of the natural herbage has been replaced by weeds that are largely useless for grazing purposes. In some cases the spread of these pests has been alarming, and the question of their eradication and replacement with good, edible herbage is worthy of very serious consideration. This aspect of the question is rarely faced by the grazier, in spite of the work of the scientific officers of the Agricultural Department, who constantly urge the trial of various grasses and plants which have been proved to be of exceptional value when planted in many parts of the State.

Edible Trees and Shrubs.—Similarly, the provision of belts of edible shade trees which could be lopped when necessary is of highest importance. Such belts are not only of importance as emergency fodder, but also act as shelter from the weather, both in summer and winter. The sheepowner should do all in his power to encourage the growth of such valuable trees, instead of carelessly cutting them out, as has so frequently been the case in the past.

Some Points in Hand-feeding.

Commence Hand-feeding Early.—It is important when a dry spell occurs not to wait until the sheep have lost condition and strength before starting to hand-feed. The weakness of a sheep that has been starved is reflected in all the internal organs, and such an animal is unable to assimilate the nourishment in the food which it ingests. It can easily be understood that there is far more chance of keeping up the condition of a healthy sheep than of one with a constitution already weakened by lack of nourishment. The hand-feeding might be commenced with small amounts while there is yet a little natural food.

Bulk Necessary when Grain is Fed.—Edible scrub, hay, dried grass, leaves, etc., all help to keep active the voluminous digestive organs of ruminants. These organs are accustomed to dealing with large masses of food, and they will not efficiently do their work with small amounts of concentrated fodder. The feeding of grain alone without the addition of some roughage will be attended with disaster. In this connection, the straw, which is held of little

account in many wheat districts, would be of inestimable value in drought time for making up the bulk of fodder so necessary to the digestive system of the sheep. The cost of saving it would be amply repaid by the number of sheep kept in health.

Maintain the Health of the Flock.—Where food of a coarse, harsh nature is used—and this applies very particularly to edible scrub—it is necessary to give some laxative in order to prevent impaction of the bowels. The large amount of fibrous matter in these foods, together with lack of water, tends to the formation of matted masses and balls of indigestible matter in the stomach and intestines. To combat this, molasses, Epsom salts, salt, etc., may be used in solution or as a lick. In purchasing a proprietary lick make certain that it contains no astringent salt, such as sulphate of iron.

When to stop Hand-feeding.—After the first rains have fallen and grass and herbage make their first shoot, hand-feeding should not at once be discontinued. The young green stuff does not contain much nutriment, and it is very laxative in action. The sudden change of diet is liable to cause severe scouring, so that hand-feeding should be continued until the natural food available is able to supply the necessary nutriment. Another reason for continued feeding is that the change of weather often has a detrimental effect on the sheep, and they are liable to be lost if not kept in good heart. Often it will be noted that in spite of their hunger sheep do not take to the young herbage at once. Many stockowners have drawn attention to the fact that their losses were heavier after the rain than during the drought, and much of the loss has been due to the sudden discontinuance of hand-feeding. These losses are, of course, quite apart from those due to flood waters, or to sheep being cut off from assistance, and are most often noted in lambing ewes.

Mixed Feeds are Advisable.—In hand-feeding no one food is sufficient to keep up the animal's strength. Under normal grazing conditions stock have the selection of a variety of herbage, and in artificial feeding variety should still be provided. To do this a balanced ration—that is, a ration combining all the constituents necessary for the health and natural growth of the body—should be adopted. This is best obtained by the use of grain, combined with some leguminous fodder. Of course, it is understood that these are not always available, or the prices may be prohibitive, and the grazier may be compelled to make what arrangements he can, according to local circumstances. It is also advisable, where it can be carried out, to vary the food so that the sheep may have a change of diet. This is of considerable advantage to the natural economy of the animal's body, and the sheep relish the change and will keep in better strength because of it.

Feeding should be Regular.—Even if the amounts given are only small, feed should be supplied regularly. At first the sheep will need to be mustered, but with regular feeding this soon becomes unnecessary. A little food given daily will produce better results than larger amounts at irregular intervals.

Give Special Attention to Weak Animals.—Arrangements must be made to feed the weaker sheep apart from the remainder of the flock. Under ordinary conditions the stronger and more pugnacious sheep get more feed than the weak. This is especially the case where troughing is used. There should be at least nine inches of troughing to each sheep. If the food is fed from the ground it should be trailed or scattered in such a way as to give all the sheep an equal chance. If necessary, the poorer sheep should be drafted off into a different paddock and fed separately: otherwise they will be robbed of their ration and death will result. Similarly, lambing ewes as they drop their lambs should be placed in a separate paddock, where they will not be hindered by the lambs from obtaining their food. If this is not done the ewes either lose their rations or forsake their lambs in order to get their own food.

The Care of Lambing Ewes.—Lambing ewes should be fed before the time of parturition approaches. In many cases it is not until a week before lambing that it is decided to feed the ewes, but there is just as much drain on the vitality of the ewe while the foetus is "in utero" as when it is born, and just as much dependence on the mother for nutriment. The ewes should be fed, if it is necessary to feed at all, during the whole period of gestation—not just at the latter end, as is usually the case.

Should the ewes forsake the lambs, special feeding is necessary. If the lambs are allowed to take their chance with the remainder of the flock heavy losses will result. Grain should be boiled or soaked before being fed to such young stock, and care must be taken that it has not soured.

Feed in Small Mobs.—It is recommended that feeding be undertaken in small mobs. There should be never more than 1,000 in each case, while better results will be obtained where the mobs are only 500.

The Water Supply.

It is not the intention in this article to deal in detail with the quality of water supply upon a farm. The whole matter has been fully discussed by Mr. F. B. Guthrie in this *Gazette* (Vol. XXIX), where recommendations regarding water and its purity are set out. The water that sheep receive during a drought depends on the local conditions. It is known to all graziers that sheep are fastidious about their water supply; be it tank, river, or bore, they take a liking to it, and will often refuse water from other sources. As the river or tank begins to dry the percentage of vegetation and mineral matter in it increases, and the sheep continue to drink it. If droved to another tank or supply they may refuse to drink for some days, especially if it is clear and free from rubbish.

These facts, however, do not affect the general principle that water for stock should be as fresh and pure as possible. Because sheep have taken a liking to a pool of muddy water, full of decaying weeds and vegetation, is no reason why they should be permitted to use it if another and better supply can be obtained. Such water not only contains the impurities referred to, but also enormous numbers of putrefactive bacteria. Owing to shortage of

food, the animals' system is already weakened, and these foreign matters irritate the digestive organs and have a far more dangerous effect than in normal seasons.

Watering, at all times and seasons, is far better carried out by troughs. Even in the western districts, it is often possible to sink wells and raise the water with windmills. The water so obtained is in every way preferable to that saved in tanks. It is clean, fresh, and cool, and has not the sediment of mud and dung which is usually present at the open end of a tank where many animals water. In addition, the supply is far more likely to be permanent. The necessity for troughs in sheep paddocks watered by bore drains is not so great, since the sheep have a great length of drain at which to water, and the water is not stagnant. A further advantage of watering from troughs lies in the fact that sheep are less liable to infection from parasitic worms, which danger always exists about open tanks.

Where, however, these tanks are the only supply available, steps should be taken to purify the water which has become foul and heavily charged with decaying vegetation and mineral matter. Water containing much mud may be clarified with lime or alum. If it contains much decaying organic material, it contains as well numerous putrefactive bacteria. At all times this is unsuitable for stock, but in drought times the sheep are more liable to gastro-intestinal derangements, and this at the very time when the water is more heavily charged with harmful bacteria. The purification of such water can be accomplished by the addition of chloride of lime. Members of the Australian Imperial Forces will recall the fact that all water used in France was purified in this way. Water was drawn from various sources, often contaminated by the proximity of dung heaps and rubbish, yet there was very little disease carried by water. One part of chloride of lime to one million parts of water was effective. More details of this treatment will be found in this *Gazette*, June, 1912.

The watering of sheep should be carried out regularly. When fodder is being provided by lopping trees, those within the vicinity of the water supply are certain to be cut out first, and the sheep may presently need to be shepherded from the fodder to the water and *vice versa*. Similarly, it may not be possible to feed artificially on other forage near the water, and in such cases also it may be necessary to shepherd the sheep to and fro. This travelling, provided it is not excessive, is an advantage as it ensures that the sheep have exercise. Otherwise, the sheep have a tendency to wait about the feeding-ground until the waggons arrive with the daily ration, thus losing the exercise usually obtained when grazing. Travelling the sheep should, of course, be limited to the cooler hours of morning and evening.

The need for water during the hot months, especially when the sheep are fed on dry feed, is very great, and it should be seen that the sheep have access to water at least twice daily.

(To be continued.)

Producing Lucerne Hay under Irrigation Conditions.

Methods and Experiences at Yanco Experiment Farm.

F. G. CHOMLEY, Manager, and F. A. CHAFFEY, Farm Foreman.

Lucerne growing for hay has in late years become a feature of some importance on this farm, and so profitable that the area has been extended year by year, until there are now 120 acres under crop, with an average production of six or seven cuts per season, and a reputation among consumers that ensures a good market for every truck forwarded to Sydney.

The methods adopted have been attended with such success as to suggest that settlers on the Murrumbidgee Irrigation Areas may yet regard lucerne as having possibilities for them. The history of this crop on the area has no doubt been checkered, and the suspicions entertained by many settlers are not without foundation and perhaps justification, but the consistent returns obtained on this farm for several years past might well be regarded as the beginning of a new chapter in local lucerne history. Some account of the various operations and the reasons therefor may indicate lines on which the crop may be grown with profit by settlers. When one recalls the nature of the lucerne plant—its wonderful capacity for throwing up one rapid growth after another—the excellent quality of the fodder—the profits that undoubtedly attach to a good stand well handled—one cannot but feel that with a combination of favourable temperature and sunshine and of assured water supply, lucerne should have a larger place in the farming of the district. In parts the soil certainly presents serious problems—almost difficulties—but the opinion may be hazarded that the number of past failures due to errors in methods of irrigation and management have been almost as great as those due to unfavourable soil and subsoil conditions—perhaps greater.

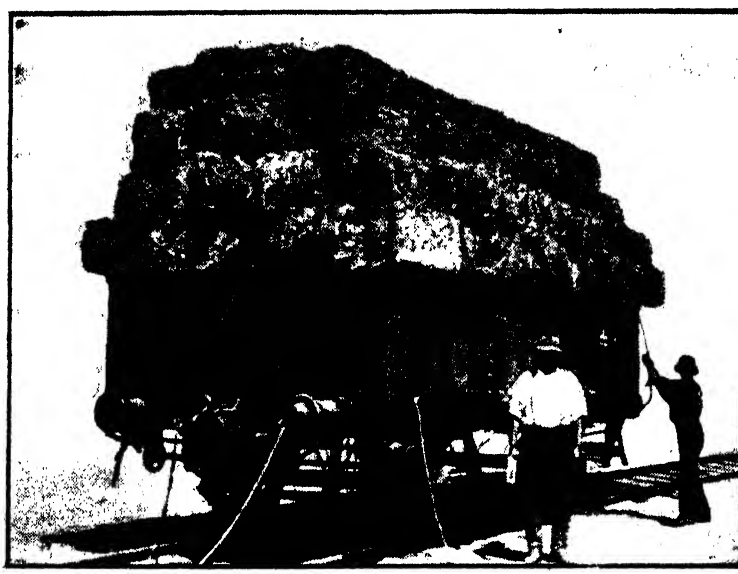
Yanco as a Lucerne District.

A brief comparison of the position of the producer of lucerne hay in a district like Tamworth with a Yanco or Mirrool grower suggests that the latter is not by any means in a bad position. On the Peel River a common rental for a first-class lucerne farm is £5 to £6 per acre per annum, while at Yanco the best of the land costs only 25s. per acre per annum, including the water rates. The Tamworth man is subject, too, to the vicissitudes of the season, to spells of dry weather, to floods, to visits of caterpillars, and to the depreciation of a couple of cuts per season by bleaching. The Yanco settler, on the other hand, is independent of the season, for his water supply is assured; he can flood his land and drown out the caterpillars if they come along, and he should be able to produce perfect hay from almost every cut. The irrigation farmer has thus all the climatic advantages, and when

it is reckoned that he has a much cheaper rent to set against the extra 60 miles of rail to Sydney market and the labour of turning on and watching the water, it seems reasonable to expect the Yanco grower some day to become more numerous and more opulent.

Soil Conditions on the Farm.

The soil on Yanco Experiment Farm is less adapted to lucerne than a good deal of land on the area, though, on the other hand, it is better than patches. It consists for the greater part of a heavy clay loam, the top soil varying from 5 to 8 inches in depth and being underlaid by a band of clay that varies from 2 inches to 22 inches in thickness. The variation in the clay subsoil is generally the reverse of that of the top soil, so that where the top soil is only



From Standing Crop to Railway Truck in Four Days.
Lucerne Haymaking with Modern Machinery.

5 inches deep the clay band is generally at its thickest, while the deeper top soil is usually associated with the minimum of clay. That the lucerne will do best where the top soil is deepest is fairly obvious; where the clay subsoil is deepest the growth is not so luxuriant, although the stalk is finer and the hay therefore of better quality.

When to Sow Lucerne.

Under such conditions care is essential in order to ensure the establishment of a good stand, and the first thing to take into account is the time when the seed should be sown. It might be said in one word—autumn. The soil is then warm, it is possible to apply the water in such a way as to ensure a saturated subsoil, and to work the surface so as to produce an almost ideal seed-bed, and the lucerne can be got above ground sufficiently before winter

to enable it to continue slowly to establish itself during the cool months, so that in the spring it is ready to respond to the increasing temperatures and to such applications of water as the weather makes necessary.

Spring sowing is quite possible, but the plant is more delicate and requires more attention, greater care, and extra labour to ensure a profitable stand. It necessarily feels the effects of the advance of summer more, not being so well established as the autumn-sown plant, and it will yield at least one cut less in the first season than a stand sown five or six months earlier. On this farm it is common now to sow blocks of 30 acres in the autumn and to do so with reasonable assurance of a good stand, but of spring sowing the area

Preparing the Land for Lucerne.
A wheat or oats crop for hay is a useful precedent to the legume.

would not exceed 5 acres. The methods adopted in spring sowing are, in essence, quite the same as for autumn sowing, the only differences being those obviously imposed by the season. For convenience, the method described in this article is that adopted for the autumn.

Preparing the Ground.

It will perhaps be appropriate to remark at the outset that as the unhindered flow of irrigation water across the field has at all times to be kept in view, it is essential that all operations shall be conducted in the direction of the fall. The ploughing must be in small lands and not round and round, or it will be found that dips will remain in the centre in which water will lie and will kill out the lucerne; on one occasion such a mistake was made on the farm some years ago and the stand suffered accordingly. Similarly, the ploughing must not be across the fall, or the inequalities of the ground

will interfere with the flow of the water. Cultivation (except of the very lightest character) must be in the same direction for the same reason. The seed drill must work the same way or the rows of the lucerne, crossing the fall of the water, will impede its advance and produce uneven watering with possibly the killing out of certain patches. The surface cultivation to which the crops are annually treated after they are two or three seasons old must be guided by the same principle. In a word—all work likely to affect the levels, even a little, must be the one way.

Louvred Smoother or Grader. Used to produce an even surface.

Side View of the Louvred Grader.

The first ploughing is usually given in December or January. It is generally found a good practice to precede the sowing of lucerne with a cereal crop. The working tends to produce a good tilth and also enables the character of the soil to be known accurately. As soon as the crop is off, the stubble land is ploughed 6 or 7 inches deep, the disc plough being used, though there is no reason why a mouldboard implement should not do quite as well. A short fallow of two or three months is allowed before a louvred grader or smoother is put over the land, across the plough, to produce an even surface.

(*To be continued.*)

Harvest Report.

Nyngan Experiment Farm.

S. RUDKIN, Manager.

The 1920 planting at Nyngan Experiment Farm consisted of 305 acres of wheat and oats on fallowed land (inclusive of experiments), and 140 acres on stubble from wheat that had been fed off. The first-mentioned area was intended for use as the main crop, and the latter for feeding off. The fallowed area was made up as follows :—Commercial area : Paddock No. 7, 100 acres ; Paddock No. 18, 140 acres. Experimental area : Paddock No. 4, 35 acres ; Paddock No. 1B, 30 acres. The unfallowed area comprised Paddock 19, 140 acres.

The Season.

The rainfall was exceptionally good, as will be seen from the following figures :—During period of fallow : 727 points. Growing period : June, 436 points ; July, 180 points ; August, 83 points ; September, 345 points ; October, 240 points ; total, 1,284. No hot westerly winds were experienced, consequently the grain filled well and high yields were the rule, much higher than in any previous year at Nyngan. A yield of 30 bushels per acre must be regarded as phenomenal.

As was to be expected, the fallows were clean at planting, and with no rain before the heavy June fall germination was good. The bulk of the hay was stacked with little rain on it, but owing to the rapid ripening some was cut rather on the late side. The grain was well filled, Sunset, Firbank, and Canberra being very good samples for Nyngan.

Paddock No. 7, *Block* 1.—Previously cropped with wheat, 1916 ; ploughed with disc 5 inches, July, 1919 ; cultivated with spring-tooth crossways from ploughing, January, 1920, and again with disc-cultivator in February ; spring-toothed just prior to planting. Hard Federation was sown with the disc-drill at the rate of 30 lb. seed and 30 lb. superphosphate per acre. The germination and the resultant crop were good.

10¾ acres gave a return of 130 tons of silage.
35¼ „ „ „ 102 „ hay.

Paddock No. 7, *Block* 2.—Ploughed with mould-board 5 inches, 1st July, 1919 ; spring-toothed in January, 1920 ; disced in February ; disc again used before planting, followed by roller and harrows. The hoe drill was used, with Hard Federation again the variety, and seed and superphosphate at the same rate as on Block 1. The germination and the resultant crop were again good. Harrows were used when the crop was about 6 inches high, across the drilling.

8¼ acres gave a return of 18 tons of hay.
45¾ „ „ „ 503 bags (1,509 bushels) grain.

Paddock No. 18.—Previous crops, rape (failure), and wheat (fed-off); this paddock had not had a successful wheat crop before. It was ploughed in September, 1919, half with disc and half with mould-board; spring-toothed across the ploughing in January, 1920, and again in April with the disc, followed by harrows before the drill. Both the disc and hoe drills were used in planting 132 acres of Hard Federation, 5·17 acres of Sunset, and 2·83 acres of Sunrise oats. Germination was good, except at the southern end of the paddock, which received a local thundershower which partly malted some of the seed. Twenty-two and a half acres of Hard Federation was cut for hay, while the remainder was stripped with the header. The Sunset was stripped on the late side, and the Sunrise oats were cut with the binder. The bulk of the wheat in this paddock was bleached, but well filled.

22½ acres	Hard Federation	gave a return of	55 tons hay.
109½ „	„ „	„ „	1,110 bags (3,330 bus.) grain.
5·17 „	Sunset	„ „	28 „ (84 „) „
2·83 „	Sunrise oats	„ „	5 tons hay.

Paddock No. 19.—Wheat after wheat (fed-off); stubble disc-cultivated just prior to the drill, followed by harrows; the seed-bed had sufficient loose earth to cover the seed; both the disc and hoe drills were used. Germination was the same as in paddock No. 18, which was adjacent. This crop was intended as a rotation crop to be fed off, but the season was so favourable that this was well-nigh impossible with the number of sheep on the farm. The crop from 17·36 acres was ensiled, and the remainder cut for hay. Both these operations were let by contract, as our hands were fully occupied on other areas. About 40 acres of the hay was well advanced.

17·36 acres	gave a return of	170 tons silage.
123½ „	„ „	278 „ hay.

It is intended to hold the bulk of the fodder as a reserve for years of scanty rainfall.

SUMMARY of Yields.

Paddock.	Acres.	Variety of crop.	Total yield.			Yield per acre.		
			Silage.	Hay.	Grain.	Silage.	Hay.	Grain.
			tons.	tons.	bus.	tons.	tons.	bus.
7	10¾	Hard Federation ...	130	...	...	12·9	..	...
7	35¼	„ ..	...	102	...	...	2·9	...
7	8¼	„ ...	...	18	...	...	2·2	...
7	45¾	„ ...	...	...	1,509	...	..	33·0
18	22½	„ ...	...	55	...	..	2·4	...
18	109½	„ ...	...	...	3,330	...	...	30·0
18	5·17	Sunset	...	...	4	...	...	16·2
18	2·83	Sunrise oats ...	...	5	...	...	1·8	...
19	17·36	Hard Federation ...	170	...	..	9·6	...	...
19	123½	„ ..	...	278	...	...	2·25	...

Farmers' Experiment Plots.

GRAIN TRIALS, 1920.

On and Adjacent to Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Assistant Inspector of Agriculture.

DURING the past season the undermentioned farmers co-operated with the Department in the trial of varieties of wheat and oats for grain :—

J. Leitch, "Glenlee," *via* Leeton.
J. N. Johnson, "Ballyearlie," Colinroobie, *via* Narrandera.
H. Booth, Farm 854, Whitton.
G. John and Son, Farm 194, Griffith.

The first two experimenters have farms situated on the dry lands adjacent to the irrigation areas, in the centre of a fairly large wheat area. On similar lands wheat has been grown more or less successfully for a number of years, and when good fallowing operations are adopted, payable crops are obtained. In such seasons as that just experienced, heavy yields have been harvested.

On both farms on the irrigation area the land sown was irrigable, but owing to the exceptionally good rainfall it was not found necessary to irrigate.

Rainfall registrations made at Leeton were as follows :—May, 31 points ; June, 213 points ; July, 276 points ; August, 261 points ; September, 286 points ; October, 166 points ; November, 153 points. Those recorded at Mr. Leitch's farm were :—May, 18 points ; June, 244 points ; July, 252 points ; August, 228 points ; September, 235 points ; October, 305 points ; November, 81 points; and on 5th December, 136 points. The last fall was of practically no use to the crop, as at that stage the early wheats had matured, and the others almost so.

"Glenlee," via Leeton.—This land consists of a red sandy loam. Wheat had been sown the previous year, but was a failure owing to the dry season. The land was then worked as if it had been a bare fallow. Both variety and manurial trials with different quantities of superphosphate were conducted. The seed was sown on 13th May, 1920, at the rate of 45 lb. per acre, and in the variety trial superphosphate at the rate of 45 lb. per acre was used. The land at sowing time was rather dry, but otherwise in good order. A shower of rain in May germinated the seed, but was barely sufficient to keep the young plants going until the break in the weather in June. Nevertheless, after these later rains the crop made rapid growth.

From the start the plot of Hard Federation fertilised with ½ cwt. of superphosphate showed most promise. It will be noticed that Zealand gave the

heaviest yields, followed very closely by Yandilla King. Canberra, practically a new variety in the district, appears very promising. It was grown by other farmers this season, and in many instances gave larger returns than Federation.

In the manure trial it was very noticeable that the land most heavily fertilised gave the lightest returns. This is hard to account for in such a season as that just experienced, when there was such an abundance of moisture, and when one would have expected an extra heavy yield. The crop appeared very good—not merely an overgrowth of straw—but as soon as the machine was put into the crop, it could be seen the return was going to be light. Many of the ears did not fill well.

"*Ballyearlie*," *Colinroobie*.—A variety trial with wheat and oats, and a manurial trial with the former, were conducted on this farm. The land was typical of the wheat areas in the district, being a red sandy loam. The experiment was sown on land that had been a failure last season, and which, after being grazed off with sheep, was worked as an ordinary fallow. Similar rates of seeding and fertilising were adopted, oats being sown at the rate of 45 lb. per acre in the variety trial. In the manurial test two different rates of fertilising with superphosphate were used, with an unmanured plot as a check. In the variety trial, Hard Federation gave the best return, and Canberra proved next best. Two varieties of oats were used, Algerian and Sunrise, and both gave good payable crops.

Farm 854.—A variety and a manurial trial were conducted on red clay loam. When this crop was sown it was intended to utilise it as a hay crop, but owing to the rank growth it was fed off, and then allowed to mature a grain crop. The seed was sown on 23rd April at the rate of 1 bushel per acre, and superphosphate at 56 lb. per acre was added.

The following mixtures were used in the fertiliser trial:—P7 (equal quantities of superphosphate and bonedust); P8 (equal quantities of superphosphate and blood and bone); M5 (2 parts superphosphate and 1 part sulphate of ammonia). Whilst superphosphate was used as a check, very little variation in yield was discovered in this experiment. Firbank gave the heaviest return in the variety trial, and Hard Federation the lowest. The low yields of the latter variety can be accounted for by part of the plot being spoiled by water lodging and the crop scalding. Otherwise this plot would have given the best yield.

Farm 194.—These plots were sown on new land, red clay loam; ploughed in May, well worked down, and seeded on 5th June, 1920; wheat at the rate of 1 bushel and superphosphate ½ cwt. per acre.

This plot was sown just before the drought broke, and derived full benefit from the good rainfall that followed. Some of the plots showed rust; this was especially noticeable with Bunyip. It is extremely doubtful if this variety should be grown on the area, for even in a normal season when irrigation is practised it is certain this wheat would be badly affected with rust.

Hard Federation gave the heaviest yield, being heavier than the next (Bomen) by over 7 bushels. Bomen produced a very fine sample of grain.

RESULTS of Variety Trials.

Variety.	Glenlee.		Colinroobie.		Farm 854.		Farm 194.	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Zealand	34	55	......		......		......	
Marshall's No. 3... ...	34	30	......		27	33	......	
Penny	32	24	24	0	......		......	
Canberra	30	0	26	30	28	27	23	10
Currawa	29	15	26	0	......		......	
Florence	28	0	25	0	......		......	
Federation (graded) ..	28	0	27	30	......		......	
Yandilla King	26	15	......		......		24	58
Federation (ungraded) .	24	25	......		......		......	
Bomen	......		26	0	......		25	2
Gresley	......		25	45	......		......	
Firbank	......		......		29	3	......	
Hard Federation... ...	......		......		27	24	32	58
Bunyip	......		......		......		15	48

RESULTS of Fertliser Trials.

		bus.	lb.
Glenlee	½ cwt. Superphosphate ...	32	24
	42 lb. ,, ...	30	54
	30 lb. ,, ...	30	18
	No manure	20	26
	75 lb. Superphosphate ..	17	42
Colinroobie ...	45 lb. Superphosphate ...	27	10
	30 lb. ,, ...	26	0
	No manure	20	30
Farm 854 ...	½ cwt. P7	26	48
	½ cwt. P8	26	25
	½ cwt. Superphosphate ...	26	12
	½ cwt. M5	25	30

The variety used in the first two cases was Hard Federation, and that in the last Yandilla King.

MR. R. F. MITCHELL, "Glen Gyle," Delungra, writes thus concerning the possibilities of Milo grain sorghum :—" I obtained seed, and the results have been surprising. I got a splendid crop, but, owing to the peculiar season, my header-harvester was engaged saving my neighbours' crops, with the result that my Milo was much knocked about by storms, though I did half an acre with the header, and obtained four bags of seed. I consider Milo has a great future in that part of Australia where wheat is grown and where there is a certain amount of summer rain, as, in such districts, the farmer will have the machinery to take it off, and he will get a crop of Milo when he will get no maize."

Four Newly Recorded Weeds.

At a meeting of the Linnean Society of New South Wales on 27th April, Mr. W. F. Blakely exhibited, from the National Herbarium, four weeds not hitherto recorded for the State.

Calandrinia caulescens H.B. et K. var. *Menziesii* Gray, a native of California and British Columbia, from Tipperary, near Young (R. Nixon, Sept., 1913), Hawkesbury Agricultural College, "Introduced with American hay" (C. T. Musson, Oct, 1917), Deniliquin (W. C. Wentworth, Oct., 1920), and Canoblas. "It produces small shiny black seeds in such quantity as to cover the ground under the plants. Stock eat it and at the stage when it is well ripe they seem to eat up the seeds as well" (W. C. Clark, Oct., 1920).

Sisymbrium altissimum L., "Tumbling Mustard;" a tall, twiggy plant, belonging to Cruciferae, from Cudal. When mature, the stems break off near the surface of the ground, and the plants are tumbled about by the wind, hence the vernacular name. The first botanical record of this plant is from the northern shores of the Mediterranean Sea, but it is now common throughout Europe, Northern Africa, Western Asia, the United States of America and Canada. In these countries it is a very troublesome agricultural weed, and every effort is being made to eradicate it.

Orthocarpus purpurascens, Benth., and *O. erianthus*, Benth., family Scrophulariaceae. Both plants are indigenous to California. They were first brought under notice by Mr. C. T. Musson, of the Hawkesbury Agricultural College, in 1916, having come up in the vicinity where stock had been fed on American hay. The former had been collected from the same locality by Mr. W. M. Carne this year, and also from Trangie Experiment Farm (C. A. Linden).—J. H. Maiden.

Winter Schools for Farmers, 1921.

Arrangements have been made for the annual Winter School for Farmers to be held at Hawkesbury Agricultural College from 21st June to 15th July. The syllabus covers a comprehensive course of lectures and demonstrations on agriculture, horticulture, live stock, &c., and in addition, practical training is available in useful work connected with farm life, such as saddlery, engineering, blacksmithing, carpentry, &c.

To meet a popular demand, a special school will be held for those who desire to specialise in the subject of poultry-farming. All branches of the industry will be fully dealt with, and, moreover, the students will be given an opportunity of studying such subjects in the general course as are likely to be of value to them.

Farmers, or their sons over 16 years of age, who have been engaged in rural work for at least one year, will be eligible for admission to the general course, and admission to the poultry course will be granted to persons of either sex over the age named who are engaged in poultry-farming.

The fee for either course, inclusive of board and lodging, will be £5. Prospectus and full information may be obtained on application to the Under-Secretary and Director, Department of Agriculture, Sydney.

The Cause of Black Disease and its Method of Transmission.*

Being Further Studies in a Braxy-like Disease of Sheep.

SYDNEY DODD, D.V.Sc., F.R.C.V.S., Lecturer in Veterinary Pathology and Bacteriology, Veterinary School, The University of Sydney.

In a previous article on black disease in sheep in New South Wales, the writer described the history, symptoms, &c., of this condition, and detailed investigations he had carried out regarding its cause. During this research no positive results such as would justify a careful worker in drawing any definite conclusions, were arrived at, and no definite opinion was expressed as to the cause, although three possible causal factors were discussed, viz., bacterial, nutritional, and plant poisoning. Reasons were given for rejecting the two latter hypotheses. The probable bacterial origin was discussed, and it was stated that the morbid anatomy of the disease indicated a toxaemia, although at that period no bacteria to account for the condition had been demonstrated with sufficient constancy in the tissues, &c., of animals dead from the disease, provided the precaution had been taken to remove such materials immediately after death to reduce the probabilities of agonal invasion to a minimum, and to completely avoid post-mortem invasion. It was also suggested that it was quite possible that the cause was bacteria which were confined to lesions somewhere, or to the intestines, where a toxin was elaborated. Furthermore, it was demonstrated that when exudates, heart blood, portions of organs, &c., taken at random, were removed immediately after death, no bacteria, with certain exceptions, could be cultivated from them.

In the earlier studies, mentioned above, a description of the post-mortem appearance of sheep dead of black disease was given, but this was compiled from autopsies made on animals, many of which had been dead an unknown although short period. It is thought desirable to record here the appearance of black disease sheep in which secondary changes have not had time to occur. The following is compiled from post-mortem examinations made on over a hundred such cases that have been seen to die, or have been killed, the examination being conducted at once.

* The present article has been written some considerable time, but owing to various circumstances a full description of the cultural and other characteristics of the causal organism has not yet been completed. Some of the former are described herein, but these relate mainly to growth in liquid media. It is fully realised that in view of the recent advance in our knowledge of the biology of the anaerobes, no description of an anaerobic organism can be considered complete unless the cultures are started from a single colony, in order to avoid the possibility that one may be dealing with mixed cultures. The writer had determined to withhold publication until this had been done, but circumstances have arisen which render it desirable that the results of six years' research in black disease be made known without any further delay. A complete description of the cultural characteristics of the causal organism, and some notes on serum reactions, &c., can be furnished subsequently. The present article also appears in the *Journal of Comparative Pathology and Therapeutics*.

The carcase is usually in good condition; and although fluke disease is very prevalent in the black disease localities, I have not seen an animal in the advanced stages of fluke infestation, affected with black disease. This is also the common opinion of sheepowners. The subcutaneous vessels are usually engorged, but not invariably so. No muscular lesions have been seen.

Either the thoracic or the abdominal cavities contain a varying amount of straw-coloured, odourless exudate, usually rather turbid in the case of the latter. A similar clear exudate may at times be found infiltrating the intermuscular tissues of the floor of the abdomen and, rarely, the perirenal tissues also. There are no distinct changes in the lungs. Almost invariably the pericardium is distended with a clear, straw-coloured exudate which soon coagulates on standing. If the examination has been delayed, these exudates may be found more or less blood-stained. The heart frequently shows hæmorrhages in the endocardium of the left ventricle, and at times on the epicardium also. These endocardial hæmorrhages may in some cases, however, be agonal in origin.

The liver, kidneys and spleen are congested, but there is no pronounced swelling of the latter. All the livers examined have shown evidence of recent fluke invasion. This organ almost invariably presents one or more necrotic foci, greyish or dirty yellowish-white in colour, firm, and odourless, varying from $\frac{1}{4}$ to 2 inches in diameter, usually circular but occasionally elongated. The edges are irregular, but sharply circumscribed. These foci may be situated anywhere in the liver substance, often superficial, but at times deeply placed and then only free incision will reveal them. Not infrequently, rather circular, hæmorrhagic areas up to an inch in diameter may be met with in the liver also. The abdominal and thoracic lymphatic glands are congested and moderately swollen. The mucosa of the abomasum is frequently congested, often in patches. In the latter case, it is usually most conspicuous around the pylorus. Small hæmorrhages may be scattered over the surface of the organ. At times (but this is by no means common) circular, superficial ulcers may be seen on the mucous membrane of the abomasum. It is probable that these ulcers when they occur are really peptic and of a secondary character. Certain areas of the mucosa are more severely damaged by the bacterial toxin or by hæmorrhage and the digestive action of the gastric juices acting on this locally injured spot leads to a loss of substance, an ulcer resulting.

The small intestines are more or less deeply congested. Occasionally they are hæmorrhagic, the congestion being most pronounced in the duodenum. At times this is the only part of the bowel affected. The large intestine is normal. Not infrequently the omentum may present numerous small hæmorrhages scattered throughout its substance. The urinary bladder and urine appear normal.

It must be borne in mind that the foregoing represents the appearances at the time of death. If only a few hours have elapsed between death and the holding of the post-mortem examination, various changes often take place which will

present quite a different picture. These have been confounded with the lesions of black disease (just as is the case with the published descriptions of the lesions of braxy in Great Britain) but must be viewed as being of purely post-mortem origin.

With the knowledge gained from the previous researches, investigations were continued during 1917, 1918, and 1919, in the field and the laboratory. It was evident that if the cause was bacterial and capable of being transmitted artificially, it was not resident in any of the materials just mentioned. The nature of some of the experiments showed that it was not a filter passer. The question then, after reviewing the subject and assuming that the cause was bacterial, resolved itself into one of two possibilities, viz. :—

(1) The causal organism was confined to the lesions, whatever these might be.

(2) It was confined solely to the alimentary tract.

Experimental work eliminated the second possibility, since the feeding to a number of sheep of minced up intestines, stomach, &c., produced no positive results, and the ascertained facts in connection with natural black disease did not support the view that infection might be due to minute injuries to the mucous membrane of the intestines. The problem was thus narrowed down to the question as to whether the causal organism, if any, was only to be found in the lesions. As before mentioned, the examination of animals before post-mortem changes had time to set in enabled one to determine which were black disease lesions and which were not. Now, although bacteria could readily be detected in the congested mucosa and submucosa of the abomasum and small intestines when a little time had been allowed to elapse between death and the removal of the tissues, these areas were found upon microscopic examination to be bacteria-free if such tissues were removed and placed in a fixative solution immediately after death. The same could be said of all the lesions in the various parts of the body, with the exception of those portions of liver containing necrotic foci. It was very evident, therefore, that if the bacteria present in such situations, with the exception of the last mentioned, were the cause of death, they must primarily have grown elsewhere, and that the submucosa of the stomach and intestines, the kidneys, blood, &c., had only been invaded during or subsequent to the death agony. Attention was, therefore, more and more focussed upon the necrotic areas in the liver. It will be seen on reference to my previous article, that even when these parts were removed directly death had occurred, there was histological evidence of an inflammatory reaction, and that the necrotic foci contained numbers of bacteria. The opinion was, however, expressed at the time that these bacteria were probably secondary invaders, since certain hæmorrhagic areas occasionally encountered in the same organ appeared under the microscope to be bacteria-free. At that period it was thought that these hæmorrhagic foci were the precursors of the necrotic areas. Accumulated knowledge has led me to change that opinion, and to now consider that the latter are not secondary to the former, and that the hæmorrhagic foci may even be due to an entirely independent cause.

To follow the reasoning in connection with the cause of black disease, it is desirable to describe more fully than previously the hepatic necrotic areas met with in this condition. One or several of these lesions may be present. Not infrequently they may show no surface indications of their existence, their presence only being demonstrated by free incision. In view of this, it is quite possible that in the early days of the investigations where no necrotic lesions were recorded, such may have been present but escaped detection because not specifically looked for. It should be mentioned, however, that on two occasions where the animal showed clinical and post-mortem signs of black disease (with the exception of these liver lesions) no necrotic areas could be detected after search. This feature will be referred to later and a possible explanation suggested.

The naked eye characters of the necrotic areas have already been described.

Histology of the Necrotic Liver Focus.

Sections show the lesion to present the appearance of coagulative necrosis. It is surrounded by a broad zone of leucocytes, which sharply delimits the normal from the necrotic portions. Immediately within the leucocytic zone are bacilli, often in thick felted masses, arranged around the whole circumference of the lesion. Many of these bacilli are of sufficient length to approach that of the filamentous. Scattered among them are single vegetative elements, but there are no long chains of many individual rods. Occasionally a sporing bacillus with a terminal or subterminal spore may be seen. The bacillary rods are thick, and have rounded ends. If death has elapsed a little before the removal of the affected portion of the liver, numerous bacilli will be found sporing. Scattered throughout the whole of the necrotic area are bacilli having the same morphology—sometimes numerous, at other times scanty. They are, however, usually single, and toward the centre of the lesion filamentous forms are rare. Here and there rounded coccus-like organisms may be seen, but these are merely the bacilli standing on end in the section. The organisms are usually present in the lesions in a state of purity, and they are strictly confined thereto up to the time of death, for although numerous sections from the livers of various affected sheep have been examined, no bacilli could be detected microscopically in the liver tissue outside the leucocytic zone surrounding the area of necrosis, not even in the hæmorrhagic foci, which are occasionally encountered in the same liver. This absence of bacilli from all places except the area of necrosis does not include those very infrequent occasions in which the animal has died from clinical black disease, but there has been no naked eye evidence of focal necrosis in the liver. Yet bacilli having the characters of black disease bacilli have been isolated from that organ. It will be seen later that it is considered that these cases are ones of mass infection, the animal dying before a gross lesion has had time to develop.

It is quite probable that invasion of the surrounding liver tissue from a necrotic focus and thence of the blood vessels, in conjunction with bacteria from the intestines may take place very soon after death. The histology of

the lesion and the disposition of the bacilli recall that of bacterial necrosis of the liver, much more common in cattle, however, than in sheep, due to the necrosis bacillus, although the morphology of the two organisms differs very considerably. In my former article, in order to guard against arriving at conclusions without sufficient evidence, it was stated that the mere presence of organisms in a lesion is not in itself sufficient to prove that those particular organisms are the cause of death of the animal in which they may be found, or that they are the cause of the disease under investigation. When, however, in animals affected with a particular disease, certain lesions are of very common if not invariable occurrence in an organ, and when in such lesions there are constantly found bacilli apparently in pure culture, further investigations are indicated as to the rôle they play. When portions of an organ containing such lesions are removed immediately after death in an aseptic manner, and placed at once in a fixative solution, the probability of *post-mortem* invasion of such tissues by bacteria is negligible. Furthermore, in addition to the necrotic lesions containing the particular organism in large numbers, there is also distinct evidence of reaction on the part of the tissues to the bacterial invasion, and the bacilli in the cases just mentioned, as far as has been ascertained, are confined to these necrotic foci.

All the foregoing factors enumerated, taken collectively, should afford satisfactory evidence that the bacteria in question were present in the situations where they have been demonstrated, some time before death occurred. They, therefore, are clearly not agonal invaders.

The question to be decided is whether the rôle they play in black disease is the primary, or only a secondary one? In my former article, I remarked that they were apparently secondary invaders, because they were absent from the hæmorrhagic hepatic foci which one occasionally met with, and because inoculation experiments on a guinea-pig and a rabbit were negative. It was at that time thought by the writer that these hæmorrhagic areas were the precursors of the necrotic lesions. This, as before remarked, I now consider in all probability to be an error; the former may have quite an independent origin *e.g.*, early acute fluke infestation, or perhaps they are due to the toxin produced by the causal bacteria. For the failure to infect a rabbit and a guinea-pig with cultures of organisms isolated from a necrotic liver focus in Case 14, described in the before mentioned article, several explanations present themselves; *e.g.*, the bacillus may have become attenuated by various means during the laboratory manipulation, especially by cultivation in glucose media, not much particular attention being paid to the preservation of virulence, as the organism at that time was thought to be a secondary invader, and with such attenuated organisms the dose administered was too small. That the bacilli do become attenuated in this manner has been demonstrated, even when fresh sub-cultures are employed for inoculation. More detailed experimental work showed pretty conclusively that the bacillus in question could not be regarded merely as a harmless secondary invader of tissues already damaged, for such work demonstrated that small amounts of virulent cultures of the organism are capable of bringing about a speedily

fatal result upon par-enteral inoculation, and that the lesions thus artificially produced by it in the sheep are anatomically those of black disease.

It remains to be stated that the foregoing views are not hasty conclusions based upon insufficient evidence, but are the outcome of the examination of, and experimental work with, tissues from a large number of sheep dead of black disease, and as controls, sheep naturally affected with various other conditions.

(*To be continued.*)

Treatment of Hoven in Cows.

Bloat, or hoven, is due to succulent foods eaten under certain conditions, which cause the formation of large quantities of gas in the rumen or paunch, and in consequence a swelling of the left flank. It is most often seen (*a*) when cattle are turned hungry on to such succulent green food as lucerne, clover, &c.; (*b*) when cattle used to dry feed are suddenly changed on to green, soft food; (*c*) when travelling cattle are allowed access to large amounts of green food, such as variegated thistle; (*d*) when cattle gorge themselves on wet grasses or herbage; and (*e*) when cattle are fed on roots or potatoes under certain conditions. Some animals appear to be more subject to hoven than others.

Keeping the mouth open with a gag, or a piece of wood, until the beast has belched most of the gas by mouth will be useful in mild cases. The internal administration of 1 oz. of bicarbonate of soda, and 1 oz. of ginger, is sometimes useful, and it may be repeated in a few hours—if necessary. In a bad case the most effective treatment is the puncture of the paunch. This is done on the left side in the flank—at a point equidistant from the last rib—the edge of the loin bones, and the angle of the haunch. The correct instrument for this purpose is trocar and cannula. The cannula is a tube through which passes a sharp-pointed instrument—the trocar. This instrument is thrust into the rumen, and the trocar is withdrawn, leaving the cannula in place, and through this the gas escapes. In case of emergency a knife may be used in the same way, the gas escaping through the cut, but complications may set in and cause death if this is not done expertly. After the gas has escaped the animal might be given a dose of linseed oil (1½ pints), and turpentine (1 tablespoonful). This mixture should be well shaken up while being given.

Every effort should be made to prevent the occurrence of hoven in stock. In feeding lucerne and clover, if the animals are not used to it, they should be put on it gradually until they become accustomed to it. If lucerne is fed in a wet state, or after heavy rain—when it is soft and juicy—it will almost always produce trouble; and cattle should, therefore, be kept off it until it is drier.—Veterinary Officers of the Stock Branch.

CORRECTION.

In the "List of Fertilisers," published in the April number of the ***Agricultural Gazette***, owing to an error in the calculation, the manurial value of No. 7 Complete Fertiliser (Wooster Fertilisers, Limited) on page 281, is wrongly given as £11 12s. 9d. per ton. The correct figure for the manurial value of this product is £12 19s.

Field Experiments with Cereals.

Glen Innes Experiment Farm.

L. G. LITTLE, Experimentalist.

[The Experiments Supervision Committee, under whose control these experiments are being conducted, wish to draw the attention of farmers to the fact that the results given below are only those of one year's trial, and that final conclusions cannot yet be drawn.]

WHEAT VARIETY TRIALS.

The object of the experiment was to determine the most suitable varieties of early and mid-season wheats to grow in this district.

The season was dry during the autumn, with severe cold conditions during early winter. Beginning in June, the rainfall was much above the average; indeed, seldom has such good rain fallen in June and July, and this thorough soaking, followed by a period of good rainfall and few frosts, ensured an excellent season for cereals.

The harvest period fortunately was fine and dry and enabled the gathering of the crops without damage.

The land had been used for wheat variety trials in 1918, and had been under a fodder crop (rye grass and clover) in 1919. In 1920 it was ploughed in April, harrowed in May, disc-cultivated when practicable in June, and harrowed twice prior to planting. The seed-bed at planting time was very sodden. Planting was carried out on 29th July, the seed being sown at the rate of 66 lb. per acre, and superphosphate at 50 lb.

The germination was slow and not very satisfactory.

None of the varieties stooled satisfactorily; the late planting seemingly caused the growth to be forced. The crops reached a height of 3 feet 6 inches to 4 feet. Florence was shortest and Early Haynes' Blue Stem tallest. The stand was thin throughout, the hay yields being light in comparison with oats.

All varieties except Clarendon and Early Haynes' Blue Stem were more or less affected by rust, which made its appearance in December, and pinched grain samples were the rule. Some ergot was noticed in the Genoa plots, and bunt in Glen Innes White.

Maturity was affected by the rust. Florence and Clarendon matured in the middle of December, but the other plots dried off at the end of that month whether they were matured naturally or strangled with rust.

The hay plots were cut in the middle of December, except Clarendon (cut on 1st December) and Florence (cut on 7th December). The grain plots were cut with the binder, the Clarendon and Florence plots on 29th December, and the others on 3rd January. Threshing was carried out in February.

The rainfall for the year 1920 was as follows:—January, 654 points; February, 113 points; March, 143 points; April, 186 points; May, 253 points; June, 419 points; July, 416 points; August, 254 points; September, 361 points; October, 225 points; November, 251 points; December, 349 points—total, 3,624 points on 165 days.

The rainfall during the actual growing period was 1,466 points for the hay and 1,555 points for the grain.

Notes on the Varieties.

Genoa (which was used as the standard) was rusted, and gave a pinched small sample; the hay yield was of fair quality.

Glen Innes White is a good hay variety; affected with bunt; badly rusted this season; yellowish pinched grain.

Glen Innes No. 2 is another good hay variety, with reddish grain; badly rusted.

Glen Innes No. 3 appears to be a satisfactory dual purpose wheat; rust-resistant; soft brownish, plump grain, and fair quality hay.

Florence is a good standard variety for late sowing; essentially a grain type here; a sparse stooler; yielding excellent grain usually, but slightly pinched this season; hay weighs heavily for bulk.

Clarendon is outstanding as a rust-resister, and a splendid yielder of excellent light grain; evidently suited by the late sowing; rather sparse stooler; early maturing and satisfactory for hay.

Early Haynes' Blue Stem is another outstanding rust-resister. It produced an excellent hay sample, being the tallest of the varieties. It is proposed to discontinue trials with Glen Innes White, Glen Innes No. 2, Wagga No. 31, and Cowra No. 3, their yielding capacity having been amply tested.

The following are the yields of the different varieties:—

Yields of Hay.

Variety in order of merit.	Yield per acre based on percentage.			Increase or decrease.	
	t.	c.	q.	c.	q.
Early Haynes' Blue Stem ...	2	17	0	17	2
Glen Innes White	2	14	0	14	2
Glen Innes No. 2	2	13	3	14	1
Clarendon	2	6	3	7	1
Glen Innes No. 3	2	5	0	5	2
Genoa	1	19	2	......	
Cowra No. 3	1	17	1	2	1
Wagga No. 31	1	15	2	4	0
Florence	1	12	0	7	2

Genoa was used as the check variety and the other varieties are compared with the average yield of that variety.

YIELDS of Grain.

Variety in order of merit.	Yield per acre, based on percentage.		Increase or decrease.	
	bus.	lb.	bus.	lb.
Clarendon	30	36	12	36
Early Haynes' Blue Stem... ...	29	38	11	38
Glen Innes No. 3	24	11	6	11
Florence	23	12	5	12
Wagga No. 31	18	0	......	
Genoa	18	0	......	
Glen Innes White	16	48	1	12
Glen Innes No. 2	14	24	3	36
Cowra No. 3	11	47	6	13

Genoa was used as the check variety, and the other varieties are compared with the average yield of that variety.

VARIETY TRIALS OF LATE SOWN WHEATS.

The object was to test a number of imported late maturing wheats with each other and with standard varieties when sown late in the season.

The season and the previous treatment of the land are mentioned above.

The plots were sown on 20th August, the seed-bed being sodden and wet, and there was difficulty in getting the seed covered. The seed was sown at the rate of 88 lb. per acre for Red Fife and 78 lb. for all other varieties. The Red Fife seed had been damaged by weevils. Superphosphate was used on all plots at 70 lb. per acre. The germination was satisfactory though slow.

In the early stages, growth was characteristically slow, stooling being on a much better scale than in the trials reported above. A remarkable feature is that these late wheats (except the varieties proved to be definite failures), made much better growth than the early maturing varieties sown a month earlier and in season. The growth was not tall, and varied considerably according to variety. The yields were influenced by the rust-resisting capacity of the varieties, and in the case of the very late varieties were closely associated with that factor. The behaviour of College Hunter, Kharkov, Kanred, Red Rock and Fultz varieties was interesting. At the time when Cleveland was harvested these varieties were still grass-like ; yet within a month the rust-resisters had run up and matured, whilst the rust-liable ones had bleached off.

The trial was a severe test as to rust-resisting qualities. Rust was bad from the middle of December. Ergot was found in Cleveland and all the very late varieties, particularly Kanred. This disease seems to attack many varieties of cereals and grasses after January, and is seldom found in anything cut before then. The maturity was widely varied.

The whole of each plot was harvested with the binder for grain. The check plots, Red Fife, Haynes' Blue Stem, Marquis, and Huron, were all cut on 11th January, and the remaining plots on 21st February.

No yields were taken, but an estimate was made of the suitability and production of the varieties in this respect.

Cleveland was certainly best, being clean and rust free, and would probably have out-yielded Genoa in the trial reported above by a ton to the acre. Haynes' Blue Stem and Marquis were lighter, rusty and of poorer quality. The same may be said of Huron, which, however, is bearded. Red Fife was slightly rusted. Kandred and Kharkov were short, rust free, and bearded.

The rainfall for 1920 has already been given. Those varieties harvested on 11th January had a total rainfall during the growing period of 1,290 points, and those harvested on 21st February had 1,440 points.

YIELDS of Grain.

Variety.	Yield per acre based on percentage.		Decrease.	
	bus.	lb.	bus.	lb.
Cleveland	32	30	......	
Red Fife	22	30	10	0
Kanred	20	4	12	26
Huron	18	19	14	11
Marquis	17	10	15	20
Haynes' Blue Stem	16	0	16	30
Kharkov	9	30	23	0
Red Rock	2	0	30	30
Fultz	......		32	30
College Hunter	......		......	

Cleveland was used as the check variety, and the other varieties are compared with the average yield of that variety.

Notes on the Varieties.

(*A*). *Late.*

Cleveland gave excellent returns this season. It stooled well, making a thick stand, and reached a height of about 4 feet. It demonstrated a great rust-resisting capacity, maturing an excellent and attractive sample of plump grain. Some ergot was noted in this variety. It was ripe on 7th January.

Red Fife is not a free stooler. Coarse flag; moderate rust-resister. Matured a nice sample of red, horny grain. It was ripe on 7th January.

Huron is a bearded variety; moderately good stooler; almost equal with Cleveland; similar to Marquis, but with larger grain. Sample was pinched. It was ripe on 1st January.

Marquis is a moderately good stooler, similar to Huron, except for having a bald head. The grain is small and pinched, being medium rust-resistant. Earlier than Cleveland. Ripe on 1st January.

Haynes' Blue Stem rusted badly this year. Moderate to good stool; tall, but not good quality hay. Grain badly pinched. Ripe on 7th January.

(B). Very late.

Kanred was imported from America. Almost rust-proof; bearded. A good deal of ergot was present. Short—growing 2 feet 6 inches to 3 feet in height—with fine, willowy stems, with a tendency to lodge; ears small but numerous, owing to good stooling, and well filled with large red, plump grain. Ripe on 2nd February.

Kharkov was also imported from U.S.A. Rust resistant; growth similar to Kanred; 2 feet 6 inches in height, with fine, willowy stems, inclined to lodge; small, bearded heads; medium well filled, with slightly pinched red grain. Latest of all. Ripe on 12th February.

Red Rock is similar to the above, and also imported. Being much less rust-resistant, it failed to produce grain satisfactorily. Ergot was noted on small bearded heads. Ripe on 31st January.

Fultz (beardless), reached 18 inches high. Rust-liable, and a total failure. Only a percentage of heads cleared the sheaths. It was imported from U.S.A.

College Hunter (imported from New Zealand), was most susceptible of all varieties to rust. Only reached 12 inches, but few heads emerged from sheaths.

OAT VARIETY TRIALS.

The object of these trials was to determine the most suitable varieties of oats to grow in this district, and to test new and imported varieties on a comparative basis with standard varieties.

The land was occupied with an oat variety trial in 1919, and with a fodder crop of rye grass and clover in 1920, the latter being ploughed under. The land was ploughed in April, harrowed in May, disc-cultivated when practicable in June, and harrowed twice just prior to sowing The seed-bed at planting time was sodden.

Planting, which had not begun when the rain set in, was carried out under conditions which did not make for good tilth. The plots were sown on 29th and 30th July, at 63 lb. of seed per acre, and superphosphate at 50 lb. The planting was a month late.

Germination was satisfactory, though very slow in the lower and colder moist parts. The oats were slower germinating than the wheats.

Being sown late, the plots did not make tall or rank growth, but were medium in height (4 feet), and very thick. Hay was cut rather later than was desirable, owing to the difficulty of drying in the wet period in December, but the heaviness of the yields is due to the extremely thick stand. The outstanding feature was the grain production. So heavy were the heads, that with just a few exceptions, the plots were generally lodged.

Very few diseases affected the oats, and of these rust was the only one to do any damage at all. Rust developed during the moist weather period in December, but only affected a few varieties.

Most varieties matured together. A hot period late in December after the previous moist cool conditions, with rust also present, caused the plots to dry off and mature.

The plots were cut for hay in the middle of December and the harvesting for grain was effected with the binder on 28th and 29th of that month, with the exception of Smyrna, which was the latest of all.

The rainfall for 1920 appears above. The oats had the advantage of 115 points after sowing in July, and 89 points of the December rainfall fell after the hay was harvested, which thus had a fall during growth of 1,466 points, as against 1,555 points for the grain.

This trial consists entirely of midseason oats of the finer leaved and fine to medium coarse-stemmed type. Such oats of the broad leaved coarse-stemmed type as have been tried have not yielded well, and have proved rather disease liable.

RETURNS from Oats Plots.

Variety in order of merit.	Yield per acre based on percentage.			Increase or decrease.	
Yields of Hay.					
	t.	c.	q.	c.	q.
Guyra	3	13	2	9	1
Smyrna	3	11	2	7	1
Lachlan	3	8	1	4	0
Algerian	3	4	1	...	
Glen Innes No. 1	3	3	2	0	3
Ruakura	2	18	3	5	2
Sunrise...	2	16	3	7	2
Bathurst No. 5	2	16	0	8	1
Kherson	2	13	2	10	3
Fulghum	2	9	2	14	3
Cowra No. 25	2	8	0	16	1
Sixty Day	2	7	2	16	3
Cowra No. 22	2	5	2	18	3
Yields of Grain.					
	bus.	lb.		bus.	lb.
Smyrna...	71	24		1	24
Algerian	70	0		...	
Guyra	66	0		4	0
Lachlan	63	28		6	12
Glen Innes No. 1	60	20		9	20
Cowra No. 25	59	0		11	0
Fulghum	58	30		11	10
Kherson	57	30		12	10
Bathurst No. 5	54	8		15	32
Sunrise...	48	4		21	36
Ruakura	47	18		22	22
Sixty Day	41	26		28	20
Cowra No. 22	41	20		28	30

In both trials Algerian was used as the check variety, and the other varieties are compared with the average of that variety.

Notes on the Varieties.

Algerian, Guyra, Smyrna, and Lachlan headed the results on both trials, though they changed their order. They are well known and standard oats, except Smyrna, and can confidently be recommended. Smyrna is an imported oat, very similar to Algerian as regards grain, later maturing, and standing better than any other variety.

Glen Innes No. 1 is very similar to Guyra; it was selected as a variety with very small awn; a fair yielder of rather short growth.

Ruakura is a good grain yielder, usually of rather short growth, but appeared to be hit early by rust this season.

Bathurst No. 5 is a tall growing oat of the Guyra type; lodged badly.

Sunrise is tall growing, but not free stooling.

Kherson is a small yellow awnless oat. It yields consistently, but never equals our best varieties; imported.

Fulghum (an imported brown oat) is consistent, but does not approach the yielding capacity of our standard oats.

Cowra No. 25 is a tall growing, medium stooler; it was a better grain yielder than Sunrise this season.

Sixty Day is a small yellow awnless oat; imported. The yield consistently falls short of standard varieties.

Cowra No. 22 made but a poor showing this year; it appeared to be affected by rust.

Adulterated Bluestone.

A paragraph appeared recently in the press drawing attention to the fact that specimens of adulterated bluestone are occasionally on the market, and inviting farmers to send samples for analysis. This should be done in every case in which the sample is suspected. The following notes will guide the purchaser as to what is to be regarded with suspicion.

Bluestone is pure crystallised sulphate of copper, and should contain nothing else. Crystals of pure bluestone are of a deep blue colour. The most usual adulterant is sulphate of iron (copperas), the presence of which gives a greenish colour to the crystals, or lightens their colour to a paler tint.

If sulphate of iron is suspected it can be easily identified as follows:—Powder a few of the crystals and dissolve the powder in water in a glass tumbler or medicine glass or ounce measure, or any glass measure of a cylindrical shape. The powder should dissolve completely in water. Now add a little ammonia-water (the "liquor ammoniæ" of the druggist). The solution will turn a very intense deep blue. Allow this to stand for 15 to 20 minutes and pour off the liquid slowly and carefully. If any sulphate of iron is present there will be a dirty green residue in the bottom of the glass, which will turn to a reddish colour if allowed to stand. Water may be added to remove the deep blue liquid still remaining and the glass again allowed to stand for a few minutes, when the colour of the iron compound will be more distinct. If the sulphate of copper is pure there will be no residue.

If there is any reason to suspect the purity of the bluestone, forward a sample to the Department of Agriculture for analysis.—F. B. Guthrie.

Ergot.

W. A. BIRMINGHAM, Assistant Biologist.

THE ergot fungus (*Claviceps* sp.) attacks many grasses. The plants attacked can be identified by a sticky secretion of the heads, and by the presence of purple bodies which replace many of the seeds or grains. The sticky secretion is due to the presence in the developing grain of a stage of the fungus known as the conidial or *Sphacelia* stage. Insects are attracted to the secretion, and the early-formed spores or conidia are spread by this means. The diseased grains are found to be later replaced by the hard purple bodies known as sclerotia or ergots. The ergot is a hard, smooth, more or less curved purple body, resembling a much enlarged grain. Infection of the ovary at blooming time is followed by complete possession and consumption of the tissue of the developing grain by the fungus. After a period of rest, usually lasting to the following season, an ergot gives rise to several small outgrowths with swollen ends. Each swollen end has in it a number of minute flask-shaped cavities, and in each of these are minute sacs each containing eight spores. Eventually the spores escape, and are ready to infect the ovaries of fresh plants.

The sclerotium constitutes the ergot of pharmacy, and contains powerful alkaloids which bring about contraction of the uterus, paralysis and gangrene. Observations and exact counts initiated by Dr. S. R. Jones* show that the loss caused by ergot (*Claviceps purpurea* Fr., Tul.) in rye is represented not only by the actual number of the sclerotia, but also by a large number of blasted kernels and empty florets. Diseased spikes were found to be shorter in length and lighter in weight than healthy ones.

Control Measures.

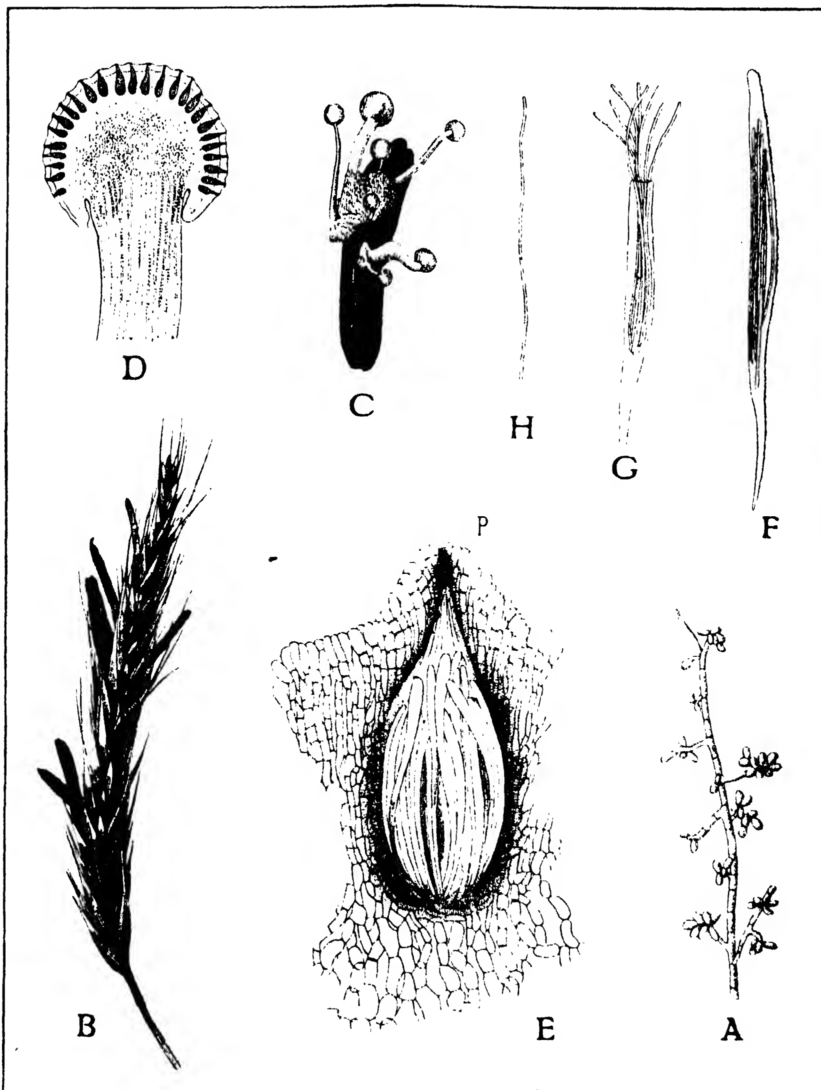
These may be summarised as follows:—

1. Proper precaution in the selection of the grain seed; in other words, the use of seed free from ergots.
2. When detected in the harvested product, the sclerotia must be shaken out or the product discarded.
3. When ergot appears in abundance on grasses in the pasture, either animals must be taken off until the ergot falls, or, where possible, the grass may be mowed with a machine the blade of which may be set high. In the latter case subsequent raking may be unnecessary.

In February, 1921, the Manager of Bathurst Experiment Farm submitted specimens of Blue grass (*Andropogon intermedius*) to the Biological Branch for examination. A sticky secretion was found associated with the panicles, due to the presence of the sphacelial stage of *Claviceps* sp. This phase of the fungus is microscopical. The ergot form was not found on these specimens.

* *Phytopathology*, Vol. II, No. 1, p. 41, 1921.

In March, 1921, the Manager of Glen Innes Experiment Farm submitted the following attacked by *Claviceps* sp., the ergot stage being present in each



Claviceps purpurea.—A, Conidial or sphacelial stage B, Ear of rye with several ripe sclerotia (ergots) C, An ergot producing stalked bodies with swollen heads D, A longitudinal section through one of the heads, showing the cavities in which the spore-sacs are borne. E, A single cavity showing the spore-sacs. F, An ascus, or sac, showing eight thread-like spores. G, A ruptured sac with escaping spores. H, A single spore. (A, after Brefeld; C–H, after Tulasne; B, after Strasburger.)

case: Wheat, rye, Hungarian or Awnless Brome (*Bromus inermis*), a canary grass (*Phalaris minor*), Loietto rye grass (a variety of *Lolium multiflorum*

and three varieties of fescue, Tall (***Festuca elatior***), Giant (***Festuca arundinacea***), and Hooker's (***Festuca hookeriana***, syn. ***Schedonorus hookerianus***). Mr. Little, the Experimentalist, states in his report to the Manager of the Farm that "all the later crops and late growth of grasses are badly infected, whilst the earlier varieties and early growths of grasses were practically free."

Ergot appears to be more prevalent in warm moist seasons. Some previous records of this fungus in Australia are:—Hooker's fescue (Glen Innes Experiment Farm, 1914) and wheat and rye (Glen Innes, 1914). McAlpine records it on Perennial rye grass (*Lolium perenne*) and Darnel (*Lolium temulentum*) in Victoria.*

Three species of *Claviceps*, the commonest of which is ***C. purpurea*** have been recorded from grasses. The other species are ***C. microcephala*** (Wallr.) and *C. setulosa* (Quel.) on Poa.

Specimens of *Pollinia fulvum* (Sugar grass) and ***Panicum bulbosum*** (Panic grass), attacked by ergot (*Claviceps* sp.) have recently been submitted to the Biological Branch by the Principal of Hawkesbury Agricultural College.

A Query Concerning a Lichen.

"I am forwarding specimens of wood containing a kind of red fungus," wrote Mr. J. R. Boller, Secretary of Bimbaya Branch of the Agricultural Bureau, in a recent letter to the Department. "Wood affected in this way seems to be wonderfully well-preserved and not to be attacked by white ants, old fences erected forty years ago being in a good state of preservation still, while others erected quite recently and not bearing the fungus are riddled with ants."

The specimen was subjected to examination by the Government Botanist, who reported that the wood was affected by a fungus or lichen-forming fungus, lichen being an association of algæ and fungi in a close relationship, in which each helped toward the life processes of the other. Before discussing the possible preservative effect of the lichen, it was necessary to consider the quality of the wood itself. The specimen appeared to have been split from a piece of red mahogany (*Eucalyptus resinifera*) and this was generally recognised as one of our first-class timbers. Formerly it had been used largely for fencing, but in its increasing scarcity recourse had been made to softer timbers. The latter were much more readily attacked by white ants and the actual resistance therefore seemed to be in the timber itself.

The algæ appeared to belong to the family *Palmellaceæ*, the host of a number of species of Lichenes usually found on fences of red mahogany. When such organisms chose for their substrata softer-wooded fence rails they tended to peel off with the surface of the wood as this became decayed by the weather. They were thus less permanent and conspicuous on the softer woods than on those of which the specimen submitted was representative.

In short, the resistance of the specimen to ants was due to the harder nature of the timber, and to this hardness was also due the pronounced growth of lichen.

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* "Systematic Arrangement of Australian Fungi," Department of Agriculture, Victoria, 1895, p. 110.

Melba XV of Darbalara.

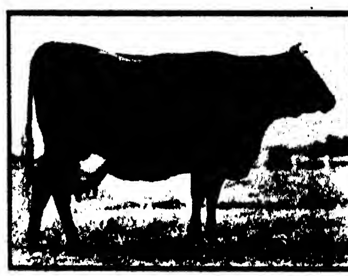
By Kitchener of Darbalara (419) ex Melba VII of Darbalara (4181).

Official Test—21,635·5 lb. milk: 954·472 lb. butter-fat.

Madame of Bolaro.
The Foundation Dam and Dam of Melba I.

Melba IV of Darbalara.
By Carbine ex Melba I.
(No official record of Melba I.)

Melba VII.
By Emblem of Darbalara ex Melba IV.



Melba XV.
By Kitchener of Darbalara ex Melba VII.

Melba XXV.
By Silvermine of Darbalara ex Melba XV.

Guardsman of Darbalara.
By Climax of Darbalara ex Melba XXV.

A Milk and Butter Record.

MELBA XV OF DARBALARA.

L. T. MACINNES, Dairy Expert.

THE *Agricultural Gazette* in December, 1917, and January, 1918, gave an account of the performances of two pure-bred dairy cows belonging to privately-owned studs in New South Wales, which had exceeded the 1,000 lb. commercial butter standard in 365 days. These yields established records for milk and butter-fat production in this State. The butter-fat record was made by the Milking Shorthorn cow Melba VII, and that for milk by the Jersey Brighton Vanilla II. The latter's production has been exceeded since by the Milking Shorthorn Lovely II of Glenthorne.

A new champion has now appeared—indeed she can be termed an Australian champion in a double sense, for she is a daughter of Melba VII. On 2nd May this year Melba XV completed a 365 days' official test under the rules of the United Pure Bred Dairy Cattle Breeders' Association, having established new records for Australia for both milk and butter-fat production.

These efforts on the part of breeders to reach record figures are not confined to New South Wales. In the other States of the Commonwealth, in New Zealand, and especially in America, there is great competition going on amongst the different breeds, each striving to surpass its rivals. The record now established by Melba XV for Australia has been exceeded in New Zealand by the Friesian Burkeyge's Sylvia Posch, and by several cows in the United States of America. The New South Wales breeder—Mr. J. T. Cole, Manager of the Scottish-Australian Investment Co's Darbalara estate—has, however, as far as is known to the writer, the distinction of making these high productions hereditary. A successful stud-master is he who can breed a high producing cow, but he is more than doubly successful who can establish a family of high producers, and make high production hereditary with both the male and female issues. Melba XV's family record has not only done this, but each generation has been an improvement on its predecessor, as the following table shows:—

	Milk yield.	Butter-fat.	Period.	Age.
	lb	lb.	days.	
Melba XV	21,635·5	954·472	365	4 years 8 mon
First dam Melba VII	17,364	870	365	6 ,,
Second ,, Melba IV	11,763	498	273	11 ,,
Third ,, Melba		No official record.		
Fourth ,, (foundation dam) Madame of Bolaro	7,763	308	273	16 ,,

Melba XV's daughter, Melba XXV, has this year completed a 273 days' test, giving 5,843 lb. milk, with 242 lb. butter-fat, as a 2-year-old heifer on her first calf. This compares favourably with the yields of her dam and grand-dam at the same age.

The records put up by Melba XV's sire, sire of sire, and grand-sire of sire are as follows :—

	Name.	No. of Daughters Tested.	Average Milk Yield per Cow.	Average Butter-fat Yield per Cow.	Period of Test.
			lb.	lb.	days.
Sire	Kitchener of Darbalara	2	12,613	522	273
Sire of Sire... ...	Emblem of Darbalara	16	9,023	385	273
Grand-sire of Sire ...	Banker of Bolaro ...	23	9,972	404	273

In five generations, with four descendants tested for the 273 days' period, at an age averaging $4\frac{1}{2}$ years, the average production of Madame of Bolaro's family has been 10,287 lb. of milk, with $457\frac{1}{2}$ lb. butter-fat.

Principal Rules Governing the Official Test.

It may be convenient to outline the rules under which tests are conducted by the Department in co-operation with the Association.

The standard for computing commercial butter from butter-fat shall be on the basis of 83 lb. of butter-fat in 100 lb. of butter.

All calculations made in computing the test shall be recorded as pounds of butter-fat, and as pounds of commercial butter.

Each test shall be over a period of twenty-four hours, and the milk shall be weighed and tested for butter-fat night and morning by a Government officer, who shall see that all cows are milked out prior to the test commencing.

The milk shall be weighed on approved scales and the weight recorded on a printed chart supplied for the purpose

The lactation period shall be 273 days, which shall be divided into a first period of thirty-three days, and eight following periods of thirty days each. The testing period of any cow may be extended to 365 days if requested by the owner, and to complete the term of 365 days the last two sub-periods shall be of thirty-one days each.

As Melba XV was tested for the first sub-period within fourteen days, inclusive, after calving, the period of 365 days was covered by thirteen tests, the last test being taken three days before the expiration of the full period, or on the 362nd day after the commencement of the test.

All cows tested under the Pure Bred Cattle Breeders' scheme are classed under three scales :—

Scale A.—For cows tested for first time within fourteen days after calving, the first sub-period record is got by averaging the first and second test results ; the second record by averaging the second and third; the twelfth record by averaging the twelfth and thirteenth tests. (Melba XV came within this scale.)

Scale B.—For cows tested fifteen to twenty-four days after calving the calculations are made on the actual tests, no system of averaging being resorted to ; the period of 365 days is covered by twelve tests only.

Scale C.—For cows tested twenty-five or more days after calving, the first record is made on the first test figures without averaging. Each succeeding calculation is computed on an average with the preceding tests; that is, the second record is got by averaging the first and second tests, and the last sub-period by averaging the eleventh and twelfth tests. The 365 days is covered by twelve tests.

The object of this system of averaging is to endeavour to make the sub-period covered by each test equal as nearly as possible to fifteen days, although the tester's visits may be at thirty-day intervals only. In all cases the yields of sub-periods are calculated and recorded in terms of butter-fat, and at the end of the full period the fat column is added up and the total recorded.

A foot-note to each record sheet shows the estimated pounds of commercial butter as calculated on the Association's standard. This standard was arrived at from the average butter-fat content of choicest pasteurised butter made in New South Wales, which, after exhaustive analysis extending over twelve months, was determined at 83·37 per cent. As the fraction would be inconvenient in calculation, the nearest whole number (83) was taken as the base.

All comparisons are, however, made officially in terms of butter-fat, as the butter standards vary considerably in each country where dairying and testing is carried on. It is to be hoped that before long the publication of records in terms of commercial butter will cease everywhere.

Melba XV's Performance.

Melba XV calved on 28th April, 1920, and was tested for the first time on 9th May. Details of each sub-period's test are given in a table hereunder. She was milked twice daily only, was housed at night during the winter, and at other times was allowed to graze in the open.

Melba XV is a deep red, well-framed cow, showing good constitution, and Milking Shorthorn type, and well-developed udder and milk veins. She was served by Lily's Cupid of Darbalara on 21st October and again on 27th of the same month by the same bull, but she came in season again some months later, and was finally served to Limelight of Darbarlara on 31st March, 1921, and now appears to be in calf.

Feeding.

The Manager of Darbalara estate gives the following information under sworn statement as to the food given during the full period of the test:—

564 lb	wheaten chaff.
3;003	boiled maize (grown on the estate).
2,110	wheaten bran.
1,698	,, pollard.
1,135	linseed meal.

The fodder was valued at £50 11s. 9d., and in addition the quantity of green fodder (grown on the estate) and pasture consumed is valued at £10 8s., or a total value of £60 19s. 9d.

The green fodder supplied was:—June to September inclusive, a small quantity of oaten hay and lucerne. January to March inclusive, a small quantity of green maize and lucerne.

Approximating the average return for the year's commercial butter at 2s. per lb., and allowing $1\frac{1}{2}$ per cent. to represent roughly the losses entailed in separating and churning the cream and in packing the butter for market, the value of the cow's production works out as follows:—

Butter-fat	£109	13	4
Skim-milk	16	4	6
Total	£125	17	10

Deducting from this the cost of feeding, £60 19s. 9d., leaves £64 18s. 1d, out of which has to come the attendance and labour expenses. The value of any progeny that may be got, not only on the present calving but from the

past and future ones, as well as the enhanced value of the progeny from any of the Banker and Madame Melba families, has also to be credited to the earnings of this cow over the past twelve months. This sum cannot be even approximately estimated, but it may run to thousands of pounds. For instance, the yearling bull calf of Melba XV's daughter was sold in March last at 400 guineas, a price far in advance of any previous sale made of this strain, and one result of his grand-dam's production as revealed by the test then just about to be completed.

Melba XV's Pedigree.

On the dam's side, the pedigree of Melba XV is as follows:—

Dam—Melba VII of Darbalara.
Sire of dam—Emblem of Darbalara.
Second dam—Melba IV of Darbalara.
Sire of second dam—Carbine of Darbalara.
Third dam—Melba of Bolaro.
Sire of third dam—Banker of Bolaro
Fourth dam—Madame of Bolaro.
Sire of fourth dam—Heather of Bolaro.
Fifth dam—Podge.
Sire of fifth dam—Major V.

On the sire's side the pedigree is:—

Sire—Kitchener of Darbalara ex Lily II of Darbalara.
Sire of sire—Emblem of Darbalara ex Madame of Bolaro.
Grand-sire of sire—Banker of Bolaro ex Violet.

Lily II gave 8,798 lb. milk with 335 lb. butter-fat in 273 days when 8 years old. There is no official record of Violet's production.

The following is the official record of Melba XV's performance.—

Date of Test.		Milk, lb.	Fat, %	Butter Fat, lb.	Butter Fat, per day.	Butter Fat, for Sub-period.	Milk, per day.	Milk, for Sub-period.	Sub-period days.
1920.					lb.	lb.	lb.	lb.	
9 May ..	Evening	32½	5·0	1·625	Averaged with June.				
,, ..	Morning	36	4·4	1·584	3·3325	109·972	73¾	2,433·75	33
11 June ..	Evening	37	4·8	1·776	Averaged with July.				
,, ..	Morning	42	4·0	1·680	3·085	92·55	74¼	2,242·5	30
10 July ..	Evening	35½	3·9	1·384	Averaged with August.				
,, ..	Morning	35	3·8	1·330	2·859	85·77	72¼	2,167·5	30
13 August ..	Evening	39½	4·2	1·659	Averaged with September.				
,, ..	Morning	34½	3·9	1·345	2·838	85·14	71¼	2,137·5	30
12 September	Evening	34½	4·0	1·380	Averaged with October.				
,, ..	Morning	34	3·8	1·292	2·797	83·91	69	2,070	30
17 October ..	Evening	34	4·0	1·360	Averaged with November.				
,, ..	Morning	35½	4·4	1·562	2·92	87·6	67¾	2,032·5	30
9 November	Evening	32	3·7	1·184	Averaged with December.				
,, ..	Morning	34	5·1	1·734	2·767	83·01	62	1,860	30
5 December	Evening	28	4·2	1·176	Averaged with January.				
,, ..	Morning	30	4·8	1·440	2·508	75·24	55	1,650	30
1921.									
4 January ..	Evening	25	4·2	1·050	Averaged with February.				
,, ..	Morning	27	5·0	1·350	2·337	70·11	51¼	1,537·5	30
3 February..	Evening	25	4·1	1·025	Averaged with March.				
,, ..	Morning	25½	4·9	1·249	2·226	66·78	45¼	1,357·5	30
3 March ..	Evening	18½	4·8	·888	Averaged with 3rd April.				
,, ..	Morning	21½	6·0	1·29	1·90	60·76	36¾	1,139·25	31
3 April ..	Evening	15	5·2	·78	Averaged with 29th April.				
,, ..	Morning	18½	5·2	·962	1·73	53·03	32½	1,007·5	31
29 April ..	Evening	14½	5·4	·783					
,, ..	Morning	17	5·5	·935	....	....	....	....	....
				Totals ..	....	954·472	....	21,635·5	365

Estimated quantity commercial butter 1,149·966 lb.

Treatment of Scab in Seed Potatoes.

C. O. HAMBLIN, B.Sc., B.Sc.Agr., Assistant Biologist.

A METHOD for the treatment of scabby potato-seed by hot formaldehyde having been described in America,* it was suggested that the Biological Branch of this Department should try it on a small scale.

In June, 1920, 7 lb. of badly scabbed potatoes were secured. Examination showed that they contained the fungus *Rhizoctonia solani,* which was evident in the form of black nodular bodies (*sclerotia*) on the skin of the potato and fine fungus threads ramifying over the surface, affecting the eyes and causing very evident scabbing of the skin of the potato.

This badly-scabbed sample was divided into two equal parts, and one half was treated as follows:—A solution of one part of commercial formalin solution (known as 40 per cent.) in 120 of water was made and heated to 122 degrees Fah. The potatoes were placed in a wire basket and immersed for two minutes in the solution, placed on a draining board, and covered with a cloth that had been soaked in the hot solution and wrung out slightly. The tubers were left covered for one hour and then laid out on a bench till air-dry. The other half of the sample was not treated in any way.

The two parcels were forwarded to the Hawkesbury Agricultural College for planting. Sowing was carried out on 28th August, 1920, the two rows being placed side by side, 3 feet apart. The potatoes were 18 inches apart in the rows. Mr. Henrick reported that "germination was good throughout."

The resulting tubers were lifted on 25th January, 1921, and samples from both plots were examined at the Biological Branch on 31st January. The potatoes were carefully washed free of adhering soil without the skins being rubbed in any way, and each tuber was scrutinised in turn for the presence of scab diseases.

There are three main local causes of scab on potatoes, two of which are fungus diseases:—(1) *Rhizoctonia solani,* (2) *Actinomyces scabies* (Oospora scabies), and (3) Eelworms (*Heterodera radicicola*).

The second is difficult to detect, but it is not thought that it was present in the specimens sown or harvested. The first cause of scab was present in abundance. The third cause of scab is relatively common.

The following results were obtained upon examining each of the harvested tubers:—

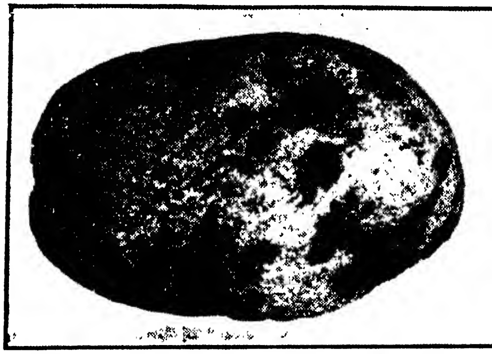
	From treated plot.		From untreated plot.
Rhizoctonia scab ...	5	...	131
Clean ...	181	...	18
Scab of doubtful origin ...	11	...	8
Eelworms ...	26	*Rhizoctonia* and eelworms ...	8*

* Also included under *Rhizoctonia* scab.

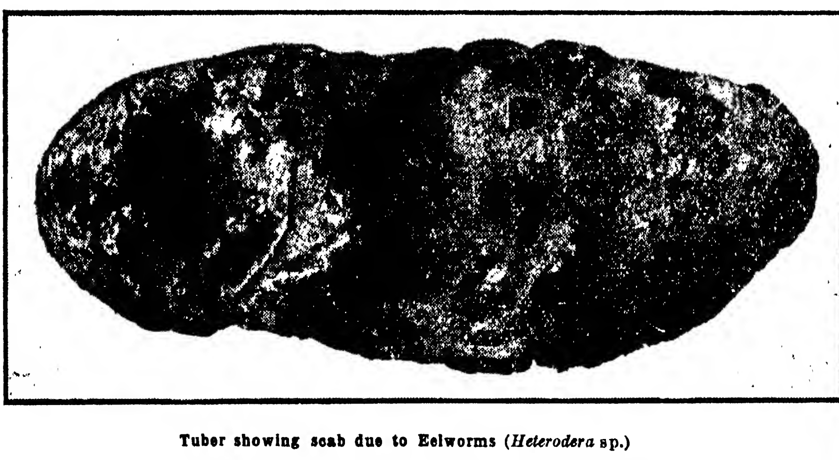
* An Improved Method of Potato Seed Treatment, I. E. Melhus and S. C. Gilman, Iowa A. E. Sta. Circ. No. 57, March, 1919.

The limited amount of scab present in the lot treated with the formalin solution was due to eelworms; even the five tubers showing *Rhizoctonia* with certainty were not badly affected, whereas in the untreated plot the tubers were very recognisably scabbed.

It is probable that the eelworm infection was from the Hawkesbury Agricultural College soil, for they are known to be present there among other crops.



Tuber showing scab due to ***Rhizoctonia solani.***



Tuber showing scab due to Eelworms (*Heterodera* sp.)

The following conclusions might be drawn from the experiment:—

1. The hot formalin treatment controls *Rhizoctonia* scab of potatoes very effectively.
2. It has practically no effect on scab due to eelworms. (Eelworms penetrate the tissues of a tuber very deeply, and a satisfactory treatment of seed potatoes so affected is unknown; they should not be used for seed at all.)
3. The hot formalin treatment has not a detrimental effect on the germinating power of the seed tuber if the potatoes are unsprouted.

The method seems to be a useful one to recommend to farmers who are growing potatoes for seed purposes, and to other growers in districts where scab has proved troublesome. It requires care, as the temperature of the solution has to be noted with a thermometer and must be maintained while the whole parcel of seed is being treated. The method of dipping scabby potatoes in cold formalin solution requires a much longer period of immersion (one and a half to two hours), and is also somewhat likely to interfere with germination of the tubers. If this treatment with hot formalin solution is carefully carried out it should give highly satisfactory results for scab due to *Rhizoctonia solani.* Tests of the treatment on a field scale will be continued by the Department.

Lucerne Seed Crop Competition at Coolah.

This competition was inaugurated by the Coolah Agricultural and Pastoral Society, a prize of £3 3s. being offered for the best five acres of lucerne crop carrying seed.

Entrance was limited to the lucerne growers of the Coolah Valley, but a considerable amount of interest was also shown by growers in districts adjacent. The quality of the exhibits in most cases was high, and the lucerne growers of Coolah are to be congratulated on being able to show such good results for their work. The quality of seed produced this year will compare very favourably with that of other centres where lucerne seed is grown. The best crops of seed in the valley were seen in localities where water can be obtained at a depth of from 18 to 25 feet. The judging was carried out on 22nd and 23rd February, and the following table sets out the results:—

	Scale of Points.					
	Vigour and density of crop.	Evenness of crop.	Freedom from weeds and grasses.	Freedom from diseases and insect pests.	Uniformity of seed crop.	Total.
Maximum points	45	10	15	10	20	100
R. J. Crosswaithe (Plot No. 2), "Pilca Butta," Leadville ...	38	9	14	7	18	86
A. W. Bull, care of A. B. Stacy, "Cossington," Leadville ..	36	7	13	8	16	80
R. J. Crosswaithe (Plot No. 1), "Pilca Butta," Leadville ...	36	7	14	6	16	79
J. Mathias, Oban Soldiers' Settlement, Coolah	34	7	13	7	13	74
E. J. Scully, "Coolahville," Coolah	32	7	13	8	13	73
H. Wentworth, "Glencoe," Leadville (Plot No. 2)	35	7	14	7	9	72
R. J. Crosswaithe (Plot No. 3) ..	36	8	14	6	8	72
H. Wentworth (Plot No 1), "Glencoe," Leadville	30	7	13	7	13	70
L. Wilson, Oban Soldiers' Settlement, Coolah	31	7	14	7	10	69
R. S. Stephen, "Mount Eva," Coolah	32	7	11	8	11	69

—J. N. Whittet, Assistant Agrostologist.

The Testing of Pure-bred Cows in New South Wales.*

L. T. MacINNES, Dairy Expert.

During the twelve months now being reviewed dairy stock-breeders have had in some districts a uniformly good season; in others, like the Illawarra, the first half was bad, and not until the late spring was there any appreciable growth in the pastures. It is noted with satisfaction, however, that those submitting their cattle for testing are resorting more to hand-feeding and balanced rations, and are thus becoming to a greater extent independent of dry spells. It is recognised, though, that even with a good ration there is an immense advantage in good pastures, for succulent, green, milk-producing fodders and grasses act as a tonic and a medicine. There are differences of opinion as to whether it is better to supplement good pastures with dry hand-fed rations, or to supplement dry rations with good grasses.

The records this year, both individually and judging by standard age averages, compare favourably with those of any previous year. Further importations, especially of Jersey, Guernsey, and Friesian strains, have been made. These have been selected from recorded production strains, and should beneficially affect the productiveness of our dairy herds in years to come.

The recognition of the value of hereditary production is one of the most encouraging aspects of dairy stock breeding, not only here, but in other dairy countries. In this connection it might be noted that in Scotland, commencing from January this year, production is to be taken into account in judging dairy stock for show purposes. Out of the total points allotted for the score, 35 per cent. is given for production, the balance being divided between type, constitution, and general appearance. Production is also taken into account in making pure-bred sales in Scotland. The highest prices are paid for the high production record strains. This is on a line with our experience. Production was recognised as far back as 1914 on the North Coast (Richmond-Tweed district) in connection with show judging. At Bangalow the production classes have been a regular feature of the district show for the past seven years, and it is pleasing to state that this year the entries have been record ones in those classes, and they are likely to be extended.

* Extracted from the official report presented to the annual meeting of the United Pure Bred Dairy Cattle Breeders' Association of New South Wales, covering the year ended 28th February, 1920.

It might be recommended to the Royal Agricultural Society that it give recognition next year to production classes, even if it were limited to a stipulation that any animal to be eligible for entry should furnish a record of a specified quantity of milk and butter-fat, or butter-fat alone. It could be guaranteed that the competition in any and all of such classes would be large and keen, and that they could be made the most prominent feature of the dairy stock section.

The Year's Work Reviewed.

NUMBER of privately-owned cows completing tests of 273 days.

Breed.	Prior to 30th June, 1917.	Year ending 28th February.				Increase at 1921 over 1920.	
		1918.	1919.	1920.	1921.	Number.	Percentage.
Milking Shorthorn ...	147	44	48	120	143	23	19
Illawarra	..	...	6	103	150	47	46
Jersey	579	19	28	59	53	(—6)	Decrease
Guernsey	37	7	9	18	23	5	28
Ayrshire	34	14	20	44	52	8	18
Friesian	...	...	12	21	20	(—1)	Decrease
Total	797	84	124	365	441	76	20·8

Animals reaching the official standards in less than the official period are included in the above table.

The increase of seventy-six shown in this table, while satisfactory, does not come up to anticipations. The Illawarra breeders are to be congratulated on showing the greatest advance. Jersey breeders ought not to allow the fact to pass that as regards their breed a considerable decrease is shown. The total number tested is the highest for any one year since the inauguration of the scheme.

The number of Government cows completing the same period or reaching the required standard under 273 days was ninety-one, as against sixty-four last year, an increase of wenty-seven.

The total number of private and Government-owned cattle tested for the full official period or reaching the standard under 273 days was 532, as against 429 last year, an increase of 103, or 24 per cent.

The total number undergoing test on 1st March, 1920, was 473, so that this year's figures show an increase under this heading of fifty-one, of which twenty-nine are private, and twenty-two Government-owned.

The number withdrawn without having completed their test was 100 less than for the previous year. Of the 173 shown withdrawn during the past twelve months, ten were from the Government studs.

SUMMARY of all cows tested for 273 days during the year, or reaching the standard under 273 days.

Breed.	Tested for 273 days.			Number on test 1st March, 1921.			Total Number withdrawn during year.
	Private.	Government.	Total.	Private.	Government.	Total.	
Milking Shorthorn	143	30	173	146	31	177	40
Illawarra	150	...	150	153	...	153	70
Jersey	53	30	83	71	17	88	18
Guernsey	23	26	49	27	29	56	22
Ayrshire	52	5	57	15	13	28	21
Friesian	20	...	20	16	..	16	1
Red Poll	...	...	...	...	6	6	1
Total ...	441	91	532	428	96	524	173

The total number of records of cows officially tested and reaching the 273-days official standard is as under:—

Number to 1918	... ...	1,547
„ during 1918–19	... ...	170
„ „ 1919–20	... ...	429
„ „ 1920–21	... ...	532
Total to 1st March, 1921	...	2,678

The total of 2,678 includes both Government and privately-owned stock. In addition, a considerable number have been tested and for various reasons withdrawn from test before the expiration of the official period, or without reaching the official standards for that period. These amount to 936.

NUMBER of privately-owned herds tested to 1921.

Breed.	1918.	1919.	1920.	1921.	Increase of 1921 over 1920.
Milking Shorthorn ...	4	13	18	24	6
Illawarra	2	10	19	29	10
Jersey	4	10	14	12	(–) 2
Guernsey	1	5	7	6	(–) 1
Ayrshire	1	3	7	5	(–) 2
Friesian	1	2	3	3	.....
Total	13	43	68	79	Nett gain 11

It is again satisfactory to note that the number of private herds has increased by eleven. Such increase is even more satisfactory than the increase in the total number of cows being submitted for test, as it shows the continued expansion of the movement over a wider area, thus bringing many fresh centres under the leavening influence of the scheme.

TABLE showing total number of cows tested, &c.

Breed.	Total number tested.			Number reaching standard.			Number below standard.			Percentage of those below standard to total tested.
	Private.	Govern-ment.	Total.	Private.	Govern-ment.	Total.	Private.	Govern-ment.	Total.	
Milking Shorthorn ..	143	30	173	102	22	124	41	8	49	28
Illawarra	150	..	150	104	..	104	46	..	46	31
Jersey	53	30	83	45	29	74	8	1	9	11
Guernsey	23	26	49	23	22	45	..	4	4	8
Ayrshire	52	5	57	40	5	51	6	..	6	10
Friesian	20	..	20	16	..	16	4	..	4	20
Red Poll	..	..	..	..	..	..	..	..	.	..
	441	91	532	336	78	414	105	13	118	22

Last year 101 cows out of 429 tested (23 per cent.) failed to reach the standard. The number failing to reach the official standard both this year and last, may be accounted for by so many new breeders commencing to test. These do not immediately grasp the benefits of regular and proper feeding, the necessity of supplementing pastures by hand-feeding and balanced rations. The first year's experience generally suffices to induce breeders to give more attention to this phase of dairying. It is borne in upon them that they cannot get the maximum out of a cow unless they properly feed her, not only during the few days immediately prior to the tester's visit, but during the whole of the intervening time. Regularity of feeding is very important.

Features of the Year's Testing.

Several features of considerable interest come forward for special reference.

The record put up by Melba XV, daughter of Melba VII, is the highest yet achieved by any cow in Australia in 273 days, and it seems as if a record for the 365-days period will be put up also. Melba VII held the 273-days record for butter-fat production previously, and still holds it for the 365 days.

The number of cows, Government and private, giving over 10,000 lb. of milk and over 400 lb. of butter-fat was as follows:—

	Over 10,000 lb. milk.	Over 400 lb. butter-fat.
Milking Shorthorn ...	10	12
Illawarra	9	11
Jersey	...	3
Guernsey	1	1
Ayrshire	...	1
Friesian	4	2
	24	30

The high average test of the Illawarra cow, Rascal, while giving such a big yield of milk, averaging 45 lb. per day with an average test of 5·1 per cent., attracts attention.

The high average test of the Jersey 2-year-old heifer, Retford Gem, viz., 6·1 per cent., with 5,556 lb. milk, is quite noteworthy.

The high average test for the breed of the Friesian cow, Oberon's Pride, 10,078 lb. milk, 4·1. per cent. average test, and of three others of this breed ranging from 4 per cent. to 4·4 per cent., also deserves mention.

Lectures.

During the year fifteen illustrated lectures were given by the Dairy Branch on the testing scheme, specially featuring hereditary production. These lectures were well attended and served to bring the value of test records under the notice of some 500 or 600 people. Such propaganda should be a means of influencing many breeders to commence testing their cows, as well as educating dairy farmers as to the value of the pure-bred sire of production strain.

Herd-testing Associations.

The other branch of the testing movement continues to make progress—slow to be sure, but still it is progress. Several units have been added to the Tweed-Richmond Council, and an additional unit has started in the Bega district, and a third is being organised. Muswellbrook, on the Hunter River, and the Gloucester district have formed associations, the latter already being at work. Inquiries have been made by other districts Altogether eleven units are now at work, testing some 10,000 cows, as against eight units with 8,000 cows twelve months ago.

Average Yields of Privately-owned Cows (273 days' test).

In the class 4 years and over, the average production over 273 days of all breeds tested shows an appreciable increase over the previous year, the figures being 7,015 lb. milk, 282 lb. fat for 1919-20, as against 7,160·6 lb. milk, 300 lb. fat for the year just ended.

In the class 3 years and under 4, the average fat yield was about stationary as compared with that of the preceding twelve months, while the milk production showed a small decline, the figures being :—

1919-20	6,479 lb. milk,	261 lb. fat.
1920-21	6,264 „	260 „

The Milking Shorthorns, Illawarras, and Ayrshires averaged below the previous year, while Jerseys, Guernseys and Friesians were considerably above.

In the class under 3 years, the average for the year 1919-20 was above that of last year, being as follows :—

1919-20	5,977 lb. milk,	251 lb. fat.
1920-21	5,537 „	235 „

Here the Milking Shorthorns, Illawarras, and Friesians declined, while the Jerseys, Guernseys, and Ayrshires considerably increased.

AVERAGE Yields of Privately-owned Cows.

Breed.	Average Yields			Equal to or above Standard.		Yields in fat.	
	Milk.	Butter-fat.	Average Test.	No. of Cows.	Excess average fat.	Lowest.	Highest.
Four years old and over: Official standard, 249 lb. butter-fat in 273 days.							
	lb.	lb.	per cent.		lb.	lb.	lb.
Milking Shorthorn ...	7,417·3	298·7	4·03	44	49·7	171·43	773·3
Illawarra	7,134	294·6	4·13	74	45·6	135·26	635·51
Jersey	6,025·7	302·3	5·01	28	53·3	160·95	402·51
Guernsey	6,823·3	333·2	4·88	13	84·2	252·01	512·33
Ayrshire	7,733·1	305·1	3·95	19	56·1	188·4	410·23
Friesian	8,730·3	313·8	3·59	7	64·8	188·83	417·72
All breeds ...	7,160·6	300·2	4·19	185	51·2	135·26	773·3
Three years and under four: Official standard, 207 lb. fat in 273 days.							
Milking Shorthorn ...	6,366·1	258·3	4·06	23	51·3	161·01	512·56
Illawarra	6,025·5	248·5	4·13	9	41·5	151·56	330·29
Jersey	5,501·3	304	5·53	3	97	227·52	380·11
Guernsey	6,424·3	316	4·92	3	109	259·32	350·91
Ayrshire	5,842·8	231	3·95	8	24	208·96	281·1
Friesian	8,865·5	318	3·59	2	111	271·36	365·53
All breeds ...	6,264·4	260·0	4·15	48	53·0	151·56	512·56
Under three years: Official standard, 166 lb. fat in 273 days.							
Milking Shorthorn ...	5,677·4	236·5	4·17	25	70·5	164·94	319·9
Illawarra	4,895	193·3	3·95	12	27·3	116·24	319·53
Jersey	4,990	260·6	5·22	12	94·6	154·23	340·66
Guernsey	5,568·6	265·8	4·77	5	99·8	210·63	333·49
Ayrshire	5,854·9	241·3	4·12	19	75·3	160·34	343·18
Friesian	6,793·2	248·1	3·65	5	82·1	150·06	331·66
All breeds ...	5,537·4	234·9	4·24	78	68·9	116·24	343·18

Average Yields of Government Stock (273 days' test).

Of cows 4 years and over, the Ayrshires show an increased average yield of both milk and fat as compared with the yields for the year 1919–20. The other breeds (Milking Shorthorns, Jerseys and Guernseys) were lower. The average for all breeds was somewhat lower last year, as is shown by the following:—

1919-20	6,391 lb. milk,	295 lb. fat.
1920-21	6,357 ,,	285 ,,

In the section 3 years and under 4, there is shown an increase in the average milk for the two years, as follows:—

1919-20	4,963 lb. milk,	253 lb. fat.
1920-21	5,164 ,,	242 ,,

Here comparison is nullified by the fact that in 1919-20 only four cows of one breed (Jersey) were recorded.

In the heifer class there is a slight increase in the average quantity of milk, but a small falling off in the amount of butter fat, the figures being:—

1919-20, average production 4,629 lb. milk, 225 lb. fat.
1920-21, „ 4,649 „ 218 „

AVERAGE Yields of Government Stock.

Breed.	Average Yields. Milk.	Average Yields. Butter-fat.	Average Yields. Average Test.	Equal to or above Standard. No of Cows.	Equal to or above Standard. Excess Average fat.	Yields in fat. Lowest.	Yields in fat. Highest.
Four years and over: Official standard, 249 lb. butter-fat.							
	lb.	lb.	per cent.		lb.	lb.	lb.
Milking Shorthorn...	7,091·8	272·1	3·84	15	23·1	152·23	345·02
Jersey	6,175·0	317·0	5·1	12	68·0	248·1	477·04
Guernsey	5,200·0	271·5	5·2	10	22·5	199·86	330·95
Ayrshire	7,720·5	295·5	3·8	2	46·5	294·42	297·45
All breeds ...	6,357·4	285·1	4·48	39	36·1	152·23	477·04
Three years and under 4: Official standard, 207 lb. butter-fat.							
Milking Shorthorn...	5,395·0	212·0	3·93	2	5·0	170·05	269·73
Jersey	4,924·0	258·6	5·2	5	51·6	219·74	290·88
Guernsey	4,782·2	247·5	5·2	8	40·5	189·55	310·15
Ayrshire	6,901·0	255·5	3·7	2	48·5	236·05	275·47
All breeds ...	5,163·7	242·4	4·69	17	35·4	170·05	310·15
Under 3 years: Official standard, 166 lb. butter-fat.							
Milking Shorthorn...	5,620·5	226·5	4·03	4	60·5	182·02	251·58
Jersey	4,099·3	209·1	5·1	10	43·1	175·74	233·28
Guernsey	4,701·3	224·3	4·8	3	58·3	201·21	243·44
Ayrshire	6,112·0	248·0	4·1	1	82·0	247·58	247·58
All breeds ...	4,649·5	217·7	4·68	18	51·7	175·74	251·58

Summary of Production Standards.

The following table shows the average yields of all Government and privately-owned cattle that have completed the 273-days tests during the last two years, compared with the official standards for the different ages:—

Class.	Official Standard	1920-21. Average Yield.	1920-21. In excess Standard.	1919-20. Average Yield.	1919-20. In excess Standard.
	lb. fat.	lb. fat.	lb. fat.	lb. fat.	lb. fat.
4 years and over	249	298	49	284	35
3 years and under 4 ...	207	232	48	260½	53½
Under 3 years	166	255	66	246	80

A New Mealy Bug on Citrus Trees.

(*Pulvinaria ornata* n.sp.).

W. W. FROGGATT, F.L.S., Government Entomologist.

THIS remarkable coccid was received on 1st November, 1920, from Mr. H. Wenholz, of the Department of Agriculture, with the information that it was plentiful in all stages of development upon the foliage of a lemon tree growing in his garden near Sydney. The first specimens collected were adult female coccids that had not commenced to produce their ovisacs; in the absence of any woolly secretion they looked like abnormally large soft Lecaniums. The description of this bug is as follows:—

Adult female light olive green, the central area dull white, with a dorsal stripe of dull brown and two rows of spots of the same colour on either side. These are what Green calls "pigmented dermal cells," but under the lens look like flattened grains of sand under the skin; when treated in potash the whole of the derm has a regular shagreened appearance. General form broadly oval, with the margins flattened and the centre convex, both the extremities rounded. Valves of anal operculum almost triangular. Length, 6 mm.

The outer margins are fringed with short, glassy rods, with more spiny hairs on the anal lobes. In the immature females the marginal rods are longer, showing a socket-like structure at the base, the antennæ slender, and the eyes red. Antennæ composed of eight joints, first and second short, third longest, fifth short, with a long bristle on the side, sixth and seventh with scattered smaller hairs, and the eighth longer than preceding ones, irregular in form, and clothed with hairs. Legs stout, with a few hairs on femur, a long hair at the apex of tibia and a few short ones on the margins; claw long, upper digitules long hairs, with spatulate tips; lower digitules short, thickened clubbed processes.

Ovisac forming a soft pad of white wool behind the coccid distinctly fluted and finely waved, with a second irregular flocculent mass of white wool rising up from the hind portion of the dorsal surface, and falling forward over the front of the resting coccid, but always more or less erect.

Male puparia dotted all over the leaves, formed of the usual white semi-crystaline substance; elongate oval, with the dorsal surface flattened and the sides sloping; apex round, operculum truncate. Length, 2 mm.

In Green's paper, "A list of Coccidæ affecting various Genera of Plants" (*Annals of Applied Biology,* 1917), nearly a hundred different species of scale insects are recorded upon citrus trees, among them nine species of the genus *Pulvinaria.* The commonest and most widely distributed species is *Pulvinaria psidi,* described originally upon the guava in the Sandwich Islands, but since recorded by Green as common in Southern India, also

upon guava and upon mango, tea, and coffee plants. From the Philippines it is reported upon fig, eugenia, and guava. This species covers the infested plants with its cottony ovisacs and produces so much honey-dew that they are smothered with black fumagine.

Pulvinaria tecta was described by Maskell from specimens sent to him by Olliff upon orange foliage submitted by a Sydney orchard. We have since had speciments upon native shrubs (*Acacias* and *Davesia*) from the neighbourhood of Sydney and Melbourne.

Both these species are allied to my new species, which, however, is more closely related to *Pulvinaria cellulosa*, described by Green from Ceylon upon citrus foliage; but none of these species, or others I have studied, have the remarkable dorsal plumes herein described, while the colouration of the adult females of the species under discussion before they commence to produce the ovisac is very distinctive. The arrangement of the dermal cells is quite different from those of *Pulvinaria cellulosa*.

My description has been made from living specimens before and after they produced the ovisacs, and the figures have been drawn from similar material.

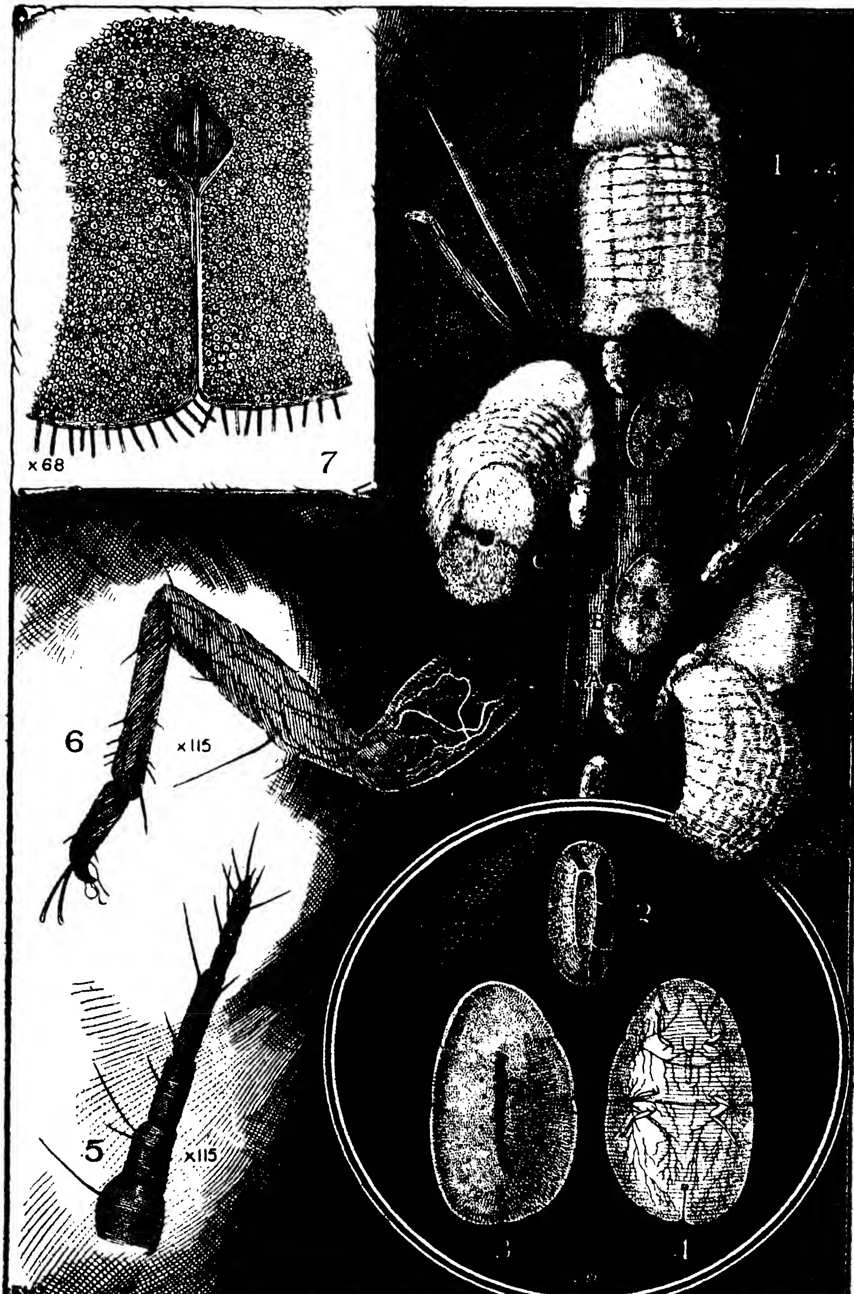
At my request Mr. Wenholz examined the plants in the vicinity of the lemon tree and found the foliage of a *Pittosporum undulatum* thickly infested with these mealy bugs. It would appear, therefore, that the pittosporum bush is the original or natural host of this mealy bug, from which it had migrated to the lemon tree.

Fallow for the Central West.

Men of experience have remarked that the system of wheat growing in parts of the western district is the worst in the State, and although this is rather a sweeping statement to make, and perhaps hardly warranted, it is nevertheless evident that there is ample room for improvement an improvement which is sure to come within the next few years. The first great improvement will undoubtedly be the more general adoption of fallowing.

As fallowing has proved successful in the Riverina, is it not likely to give even greater results in the drier western districts? A farmer with a thousand acres of crop can perhaps afford to gamble on the season, as one good year will probably compensate for two bad ones, but a farmer with only 300 or 400 acres requires a return every year, and the surest way to get it is to sow only on fallowed land.—H. Bartlett, Inspector of Agriculture.

Honey from some sources will granulate with a very "freakish" appearance, sometimes conveying a wrong impression to the uninformed who regard granulated honey with suspicion, imagining it to be adulterated. Granulation is actually the best guarantee of the purity of a sample of honey. The misconception mentioned may be attributable to the fact that some honey, if not thoroughly ripe when extracted, will ferment, and occasionally give off a very offensive odour.—H. Graham Smith, Instructor in Apiculture, Hawkesbury Agricultural College.



A New Mealy Bug (*Pulvinaria ornata* n.sp.) on Citrus Trees.

1. Top figure shows adult female with ovisac; the wool is to be seen turned in two directions :- A. Test of male on bark; B. Immature female on bark; C. Adult female covered with ovisac.
2. Test of male enlarged.
3. Dorsal surface of female before producing ovisac.
4. Ventral surface of female, before producing ovisac.
5. Antennæ of 3 and 4.
6. Hind leg of 3 and 4.
7. Anal portion of 3 (dorsal).

A good crop of Sudan Grass at Terrigal.
Many heads ran 9 feet high.

The Pruning of Rome Beauty.

W. J. ALLEN.

THE yearling lateral of the apple is of two types; one carries diminutive, almost blind axillary buds, which, the following season, if not forced, will remain dormant; the other carries plump, well-developed buds, which, according to position, will either develop secondary laterals, or fruit spurs.

In many varieties, such as Gravenstein, Jonathan, Cleopatra, Dunn's, London Pippin, Stone Pippin, and generally Granny Smith, such a high percentage of the latter type of yearling laterals is carried that it is not necessary when pruning to take into consideration the few odd laterals of the other type carrying poorly developed buds, which occur on these varieties.

On the Rome Beauty, however, the position is reversed, as mostly this variety carries a yearling lateral with axillary buds of the poorly developed type; see Fig. 1. If such laterals are left untopped, they will often crop at the tip, and perhaps form a spur or two immediately behind the club where they cropped; they seldom form any spurs between this and their base (as in Fig. 2), or perhaps form no spur at all, as in Fig. 3.

A moderate cutting, shortening back by about half (see *a* in Fig. 1) of the same type of lateral is not altogether satisfactory, as the resultant spur formation will generally be only a modification of either Figs. 2 or 3. On the other hand, if these laterals are cut hard back to the two or three buds nearest their base (see *b* in Fig. 1), a strong lateral may be started into growth, and the remaining buds will mostly spur as in Fig. 4*a*, and in some cases no strong growth will start, but spurs or very short fruiting shoots, as in Fig. 4*b*.

As a matter of fact the yearling laterals shown in Fig. 1 are not their full length and do not show their base where they united with their parent limb. Usually the buds at the base cluster together more (see right hand lateral in Fig. 5), and thus the cut *b* shown in Fig. 1 would generally be closer to the base.

The above method of hard cutting of this type of lateral on the Rome Beauty apple has been very thoroughly tested out at our Bathurst Experiment Farm Orchard, and the results have been consistently satisfactory. If, however, on rich, deep soils, young and vigorous Rome Beauty trees should again throw only long growths instead of spurs or short fruiting shoots from where the laterals were cut hard in the winter, it would then be necessary to repeat the operation on the new growth in the latter part of January, or if not done then, at the following winter pruning.

The type of lateral with plump, well-developed eyes (see Fig. 5), if left long will generally crop on the tip, and also develop spurs along its length, as in Fig. 6. However in trees that are well furnished with spurs and not

making abnormally strong growth, it is advisable to shorten such laterals slightly as at *b* in Fig. 5. With more slender laterals, or those situated on lower parts of the tree where a further vigorous growth is not expected, they may be shortened to about *c*, in Fig. 5, when a result as in Fig. 7 will follow.

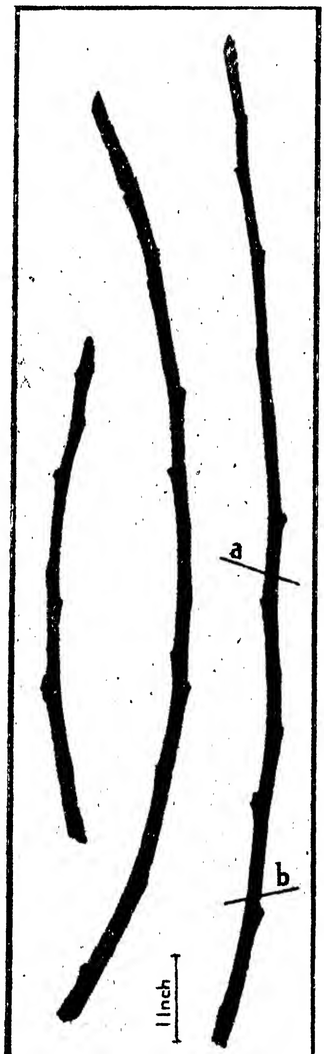


Fig. 1.
Yearling laterals of Rome Beauty carrying diminutive, poorly developed buds.

Fig. 2.
Two-year-old Rome Beauty laterals of the type shown in Fig. 1, untopped the previous season and showing spur development only immediately behind the club where they cropped.

On the coast and tablelands, as a rule, the yearling lateral with plump, well-developed buds is only of exceptional occurrence in the Rome Beauty, and is so conspicuous that a pruner can pick it out and deal with it as above without checking his speed. In some seasons this class of lateral will be

Fig. 3.

Two-year-old Rome Beauty laterals of the type shown in Fig. 1, untopped the previous season, and showing no spur development at all.

Fig. 4.

Similar two-year-old Rome Beauty laterals to those shown in Fig. 1, showing spurs and fruiting shoots developed from heavy topping.

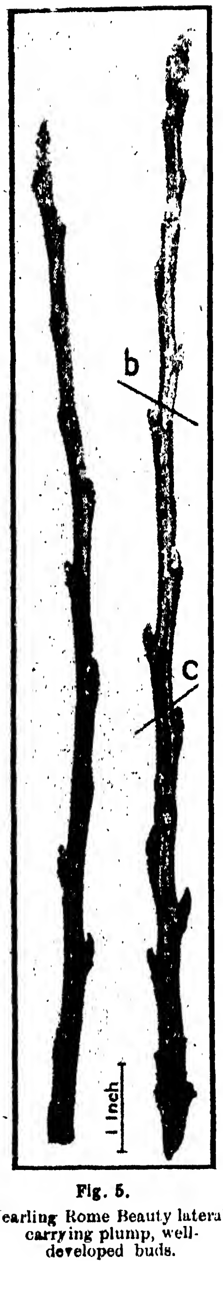


Fig. 5.
Yearling Rome Beauty laterals carrying plump, well-developed buds.

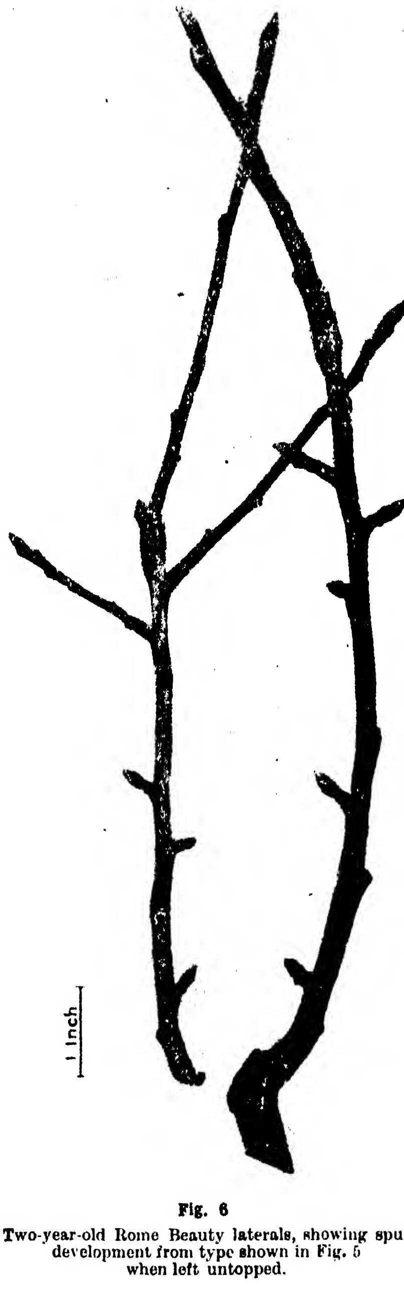


Fig. 6
Two-year-old Rome Beauty laterals, showing spur development from type shown in Fig. 5 when left untopped.

Fig. 7.

Two-year-old Rome Beauty lateral showing spur development when the type as shown in Fig. 5 is topped.

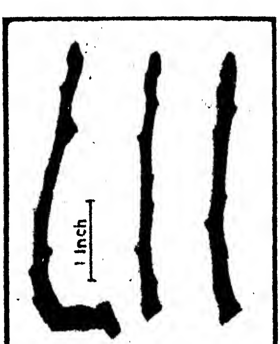


Fig. 8.

Yearling fruiting shoots of Rome Beauty.

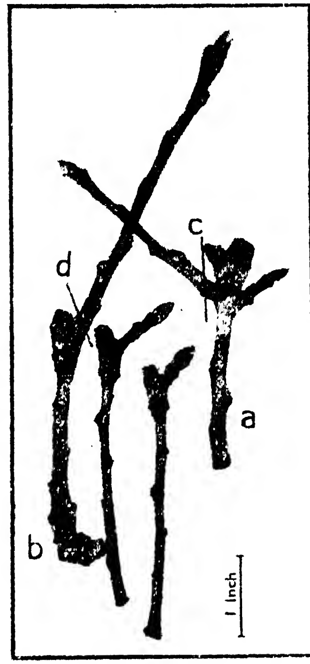


Fig. 9.

Two-year-old fruiting shoots.

Fig. 10.

The result of cutting back the extension of a fruit shoot that failed to crop the previous season.

found quite abundant, even in districts where its occurrence is usually exceptional. This was the case a couple of seasons ago, and on that occasion it was also noticed that instead of developing into spurs, as usual, the buds blossomed and dropped out. In some of the warmer inland parts of the State, especially on the granite soils of the southern wheat districts, this type of lateral is usually very pronounced, and often the other type becomes the exception.

The fruiting shoot (in other words a very short lateral carrying a terminal fruit spur as in Fig. 8), can be left uncut; it will then generally crop on the tip, form a club, and either spur at the club or immediately behind it (see Fig. 9). If it should also make a shoot, as in Fig. 9 *a* and *b*, the extension should be removed close to the club as shown by the lines *c* and *d*. It will be noticed that Fig. 9*b* has cropped, clubbed, and made an extension, but has not spurred, but if the extension is removed as directed, a spur will form at the club, or directly behind it, during the following growing season, as in Fig. 9*a*. If a fruiting shoot fails to crop and club, but just makes an extension, the extension can be dealt with as a yearling lateral, that is, cut back to two or three eyes nearest its base. Fig. 10 shows the result from cutting in this manner the previous season.

Dollar Wheat.

Some prominence has been given to Dollar wheat, and Mr. A. E. V. Richardson, Superintendent of Agriculture in Victoria, whence the variety comes, lately afforded the information that it is a selection made by Mr. Muller, of Kinamatka, near Nhill, Victoria. It has done sufficiently well at Longerenong Agricultural College to justify its further trial.

In tests made in selection plots (one-twentieth of an acre), the yield of typical varieties was :—

Gallipoli	64 bushels.
Selected Federation ...	58 ,,
Dollar	51 ,,
Hard Federation ...	43 ,,

Mr. Richardson added that the small amount of seed obtained from these selection plots has all been distributed. It appears at the present moment that while the variety is a promising one, its yield in competition with standard types has not been unusually high.

Since the prohibition of beekeeping in box hives, the output of beeswax has largely been reduced, and the prices in Sussex-street have for some months remained firm in the vicinity of 2s. per lb. Large quantities of beeswax are used in the manufacture of comb foundation, and still larger quantities will be used for this purpose when beekeepers appreciate more fully the advantages of full sheets of comb foundation as a means of obtaining profitable brood combs.—H. Graham Smith, Instructor in Apiculture, Hawkesbury Agricultural College.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture now publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of wheat, oats, maize, sorghum, Sudan grass, potatoes, and other crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Wheat :—

Bomen	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	H. M. Hall and Sons, Studbrook, Cunningar.
Canberra...	S. M. Haig, Lisburn, Wombat.
	H. K. Nock, Nelungaloo.
	E. J. Allen, Gregra.
	R. J. O. Berryman, Aniemoore, Botfield's Siding.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Clarendon	J. Parslow, Collie-road, Gilgandra.
Cleveland	W. Burns, Goongirwarrie, Carcoar.
	Manager, Experiment Farm, Bathurst.
College Purple	Manager, Experiment Farm, Temora.
Comeback	Manager, Experiment Farm, Temora.
Currawa	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	J. Parslow, Collie-road, Gilgandra.
Federation	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Bathurst.
	J. Parslow, Collie-road, Gilgandra.
Firbank	Manager, Experiment Farm, Nyngan.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
	J. Parslow, Collie-road, Gilgandra.
Florence	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Condobolin.
	J. Parslow, Collie-road, Gilgandra.
	H. K. Nock, Nelungaloo.
Genoa	Manager, Experiment Farm, Glen Innes.
Gresley	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Hard Federation	E. J. Allen, Gregra.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Nyngan.
Improved Steinwedel	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Condobolin.
	Manager, Experiment Farm, Temora.
King's Red	Manager, Experiment Farm, Temora.
King's White	Manager, Experiment Farm, Temora.
Marshall's No. 3	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Cowra.
Marquis	Manager, Experiment Farm, Glen Innes.
Major	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Temora.

PURE SEED—*continued.*

Wheat—continued.	
Onus	H. K. Nock, Nelungaloo.
Penny	E. J. Allen, Gregra.
	W. W. Watson, "Woodbine," Tichborne.
	Manager, Experiment Farm, Temora.
Roseworthy	H. K. Nock, Nelungaloo.
Thew	Manager, Experiment Farm, Glen Innes.
Turvey	W. W. Watson, "Woodbine," Tichborne.
	H. K. Nock, Nelungaloo.
Warren	Manager, Experiment Farm, Trangie.
Warden	W. W. Watson, "Woodbine," Tichborne.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Manager, Experiment Farm, Temora.
Yandilla King	W. L. Forsyth, Braeside, Wallendbeen.
	E. J. Allen, Gregra.
	S. M. Haig, Lisburn, Wombat.
	H. M. Hall and Sons, Studbrook, Cunningar.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Zealand	Manager, Experiment Farm, Temora.
	H. K. Nock, Nelungaloo.
Oats :—	
Algerian	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Cowra.
Ruakura...	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Cowra.
Guyra	S. M. Haig, Lisburn, Wombat.
	H. K. Nock, Nelungaloo.
Sunrise	Manager, Experiment Farm, Cowra.
	H. K. Nock, Nelungaloo.
	Manager, Experiment Farm, Glen Innes.
Lachlan	Manager, Experiment Farm, Cowra.
White Tartarian	Manager, Experiment Farm, Glen Innes.
Barley :—	
Cape	Manager, Experiment Farm, Bathurst.
Kinver	Manager, Experiment Farm, Temora.
Goldthorpe	Manager, Experiment Farm, Temora.
Sudan Grass :—	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Temora.
	J. Cavanagh, Curlewis.
Clovers :—	
Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
Maize :—	
U.S. 133...	P. Gersbach, Farm 330, Leeton.
Golden Glow	J. F Chick, Hillview, Tenterfield.
Silver King	A. Sommerlad, Hillcrest, Tenterfield.
Early Yellow Dent	Manager, Experiment Farm, Glen Innes.
Silvermine	Manager, Experiment Farm, Yanco.
Tunk's Yellow Dent	J. Ditzell, Lansdowne, Inverell.
Boone County White	J. Chittick, Kangaroo Valley.
Leaming...	Manager, Experiment Farm, Grafton.
Golden Beauty . .	R. Richardson, Mondrook, Tinonee, Manning River.
Manning Pride	S. Smith, Karaak Flat, via Wingham.
Golden Nugget...	J. W. Smith, Wauchope.
Manning White	A. McM. Singleton, Henley, Sydney.
Red Hogan	Principal, H. A. College, Richmond.

In addition to those tabulated a number of crops were inspected and passed for purity, but as the growers failed to forward samples their seed has not been listed.

With regard to Sudan grass, it should be noted that though listed above, it should not be sown until spring.

Vineyard Notes for June.

H. L. MANUEL, Viticultural Expert.

A START will be made at pruning on some of the vineyards this month. No hard and fast rule can be laid down as to the exact time to commence the work, as so much depends upon the vinegrower's experience with his varieties, and the seasonal conditions in his particular district. Where a district is subject to late frosts, pruning will be delayed as far into the season as possible. In a prolonged winter, some varieties, when pruned very late, show a decided improvement in the setting of their fruit. In the case of large vineyards, however, the grower is compelled to make an early start to get through his work.

The subject of pruning is a large one, and it cannot be dealt with fully here, but the following few remarks should prove useful. In the pruning of last year's plantings, except in the case of an odd, very vigorous grower, cut back and remove everything but one spur and cut that to two buds. Vines showing weakness require hard pruning. Vines that have been hard hit by downy mildew and other diseases this year will have made weak and sickly growth, and a certain amount of dead wood. Hard pruning and the removal of dead wood is essential in these cases, and will actually assist the vines to recover more quickly. The main object of the pruner should be to produce the happy medium between wood and fruit production. To neglect to study the health of the vine is to prejudice its future cropping capacity.

Pruning tools should at all times be kept in proper order. The blade of the shears should be sharp, and free from bevel or shoulder, for a shoulder on the blade causes splitting and bruising when the cut is made. Again, tools kept in good nick will greatly facilitate the work ; the strain on the wrist is not so great, and the work can be done at a faster rate.

As a reminder to those who intend to practice field grafting later on, I may mention that the scion wood for the purpose must be reserved before the vine cuttings are burnt. To keep the cuttings in good condition, cut them directly after pruning, and tie in bundles of not less than fifty, placing the bundles in dry sand and covering them thoroughly. Where space permits, the cuttings can be put singly in rows. In both cases cover well with a deep layer of sand, and from time to time until they are required, they should be inspected as to the condition they are in. If they should show signs of drying out, uncover and allow them to soak in water for a day or two before replacing them in the sand ; on the other hand, if the covering happens to be moist and is likely to force the buds to sprout, that trouble must also be guarded against.

Ploughing.

Where it is possible to delay the first ploughing until well into the season it should be done, but care should be taken not to be caught by dry conditions setting in early in the spring. The practicability of the advantages sometimes claimed for early ploughing I question, and my chief reasons for doing so are as follows :—

Soils of a clayey nature if ploughed early, will set very hard under the influence of the heavy winter rains, and being left in a rough state will materially affect the second ploughing. Not only will the work be uneven, but the rough state of the ground will increase wear and tear on the implements, and be exceedingly hard on the horses' shoulders. Harrowing the early ploughed ground will certainly get over this difficulty, but in harrowing early, the running together of the soil is hastened.

Weeds do not make much headway until the weather warms up later in the season, and rubbish growing on ground that is more or less rough cannot be turned under as satisfactorily as that growing on more level ground.

Where it is possible, then, I favour ploughing later in the season, and harrowing immediately afterwards. Under this treatment the surface soil does not receive the full mechanical force of the rains, and therefore remains in a more mellow condition for the second ploughing.

Before starting ploughing, the opportunity may be taken to apply lime and manures.

A Bad Bee-keeping Practice.

A recent correspondent inquired whether, if he were to clip virgin queen bees for the purpose of forcing them to become drone layers for the production of drones for mating purposes, would such drones be good enough to mate with other queens?

Let it be said at once that the suggested practice is a very undesirable one. In the first place, if there is worker comb in the hive, the queen will select such comb to lay in, and the drones produced will be undersized ; and, if drone comb is used exclusively, the effect will be malnutrition, or undesirable drones of poor stamina. It is almost invariably noticed that, where there are a good number of drones raised as above, the percentage of improperly fertilised queens in the apiary is high. The stamina of the drone bee is, in my opinion, quite as important as that of the queen, and the best drones only should be produced, being raised naturally by the bees under stimulating normal conditions.

A good way to procure early drones is to stimulate by regular feeding a number of the best Italian stocks. The drones from undesirable colonies can be kept down by using for breeding purposes the best worker combs in the hives, and by the use (especially at the time when young queens are due for the mating flight) of drone traps.—W. A. Goodacre, Senior Apiary Inspector.

Poultry Notes.

JUNE.

JAMES HADLINGTON, Poultry Expert.

As indicated in last month's notes, the hatching season should commence from 1st June, and all available eggs from the breeding pens should be set, although, in the case of those fortunate enough to have more than the ordinary number of eggs available, it might be of questionable wisdom to set too many incubators at one time, unless the brooding capacity is capable of handling all the chickens likely to be hatched. That is to say, with ordinary brooder units of, say, 100 capacity, it would not be wise to fill up at once—even if that were possible. It is better to co-ordinate the incubating and the brooder capacity by ensuring that a succession of chickens shall be hatched out each week, which at the end of six weeks will go out into the rearing pens in the same order. This will enable fresh eggs to be set every week instead of incubation having to be suspended, or overcrowding will occur owing to the pressure of chickens on the brooder space during the remainder of the season. In other words, we should not allow the desire to have a large number of chickens to weaken the systematic working of the whole plant. It should be borne in mind, too, that mere numbers of chickens will not make for success unless they are all reared well.

Any reader who has not seen the leaflet "Rearing and Feeding Poultry," issued in time for the Royal Show, should make application to the Under Secretary and Director, Department of Agriculture, Sydney, for a copy.

Substitutes for Bran and Pollard.

The question of finding some suitable substitute to take the place of at least a portion of the bran and pollard in the morning mash has exercised the Department of Agriculture for some considerable time; so much so that some months back a Foods' Investigation Committee was formed to go thoroughly into the matter of substitutes or supplementary foods. The limitations in these directions soon became apparent, and the problem is by no means as simple as might appear. One fact stands out very clearly—with the exception of lucerne, substitute articles of food are for the most part either too small in volume or higher in price than mill offal.

Of all the substitutes investigated that are likely to eke out the bran and pollard supply, none so far gives the same promise as lucerne ground into meal. Hitherto the drawback to the use of this article has been the temptation to use inferior lucerne in its manufacture, and it was seen that if this factor could be eliminated there was a wide field for its use.

In order better to secure the required quality and constant supply, the Department approached the Metropolitan Meat Industry Board with a

suggestion that they should undertake the manufacture of this article from prime lucerne hay. The proposition has now been given favourable consideration by the Board, and as an outcome they have decided at once to instal machinery to manufacture lucerne meal. It is expected that the article will be available to poultry farmers by 1st July, at a price much below that now ruling for pollard and bran.

It is estimated that the quantity of bran, pollard, &c., necessary for the morning mash in this State, is about 12,000,000 bushels per annum, and as it has been amply demonstrated by the Department that we can use up to 15 per cent. of prime lucerne meal (perhaps even a little more), the addition to the poultry farmer's food supply is a very important one.

For some years the Department has advocated the use of lucerne dust in the morning mash, partly as a means of introducing variety to the ration and augmenting the food supply, but the intermittent supply, as well as the high price at which it has been sold has operated against its use except on a limited scale.

From time to time during the last few years machine-shredded lucerne has been put on the market, and offered to poultry-farmers as lucerne dust or under other names, but owing to the high fibre content of most of the samples (due probably to its being manufactured from old, stalky lucerne), it could not be recommended. However, the class of meal, or ground lucerne, intended to be manufactured by the Meat Industry Board will be in such a granular form as to make detection of inferior samples an easy matter for the poultry-farmer himself, without resort to analysis. But quite apart from this phase of the matter, the Meat Industry Board being a State institution with all the facilities of a big plant, cheap power and storage capacity, should be able to turn out a good article at a minimum cost.

The general satisfaction its products have given should inspire confidence in this new venture of the Board, which has been undertaken not so much for profit as to assist the industry.

Green Food—Its Use and Abuse.

The high cost and scarcity of foods for feeding poultry has resulted in chaffed green food being brought more generally into use as one of the ingredients of the morning mash. There is much to recommend this practice, not only from the point of view of economy, but as a factor in keeping the birds healthy. The practice could be extended with benefit to the industry; but the use of green food can be overdone to such an extent as to cause serious loss of egg production, and when this point is reached it can only be regarded as the abuse of a good thing. Many cases have come under notice during the last few months where very serious loss has resulted from attempts to feed laying hens on a diet too largely composed of green food. As much as two-thirds has been fed in some cases, and the effects could only be injurious.

In feeding a hen it should be recognised that she has not the capacity, even proportionate to her size, of a cow, horse, or sheep to deal with bulky vegetable matter. Large quantities of roughage must be fed to the larger

animals, but it is the nature of the hen to feed on more concentrated foods, such as grain, seeds, &c., her anatomy being consequently altogether different. Not only so, but the hen is required to produce a highly concentrated product in the form of an egg, and the nutriment that it is possible for a hen to assimilate from the small amount of green stuff that her digestive system will deal with is altogether inadequate for the purpose of maintaining continuous egg production and repairing the waste of bodily tissue. If she is forced to eat a mash composed of too much of this class of food to the exclusion of a more concentrated and substantial diet, the first effect is a lower egg production. This has taken place on many farms without the reason even being suspected.

Economy in Feeding.

The use of more maize in feeding poultry has been previously advocated in these notes, and the reason for the course has been stated, but the continued high price of wheat as compared with that of maize at the present time, coupled with the extremely high cost of feeding generally, calls for a further reminder on the subject.

When it is remembered that the present cost of feeding per hen per annum on a wheat, pollard, and bran basis is, roughly, 12s., and that about 50 per cent of this amount, or 6s., is represented by the evening feed, it becomes a matter for serious consideration as to how far the use of maize will lower the cost of feeding, without loss of production. Experience tends to the conclusion that at least 50 per cent. maize can be used without ill-effects. This being the case, and taking wheat at 8s. and maize at 5s. per bushel, on the basis of three-quarters of a bushel per hen per annum (a fair average for ordinary hens), the evening feed per hen on wheat costs 6s., while on maize it would cost 3s. 9d. If we feed equal quantities of each in the evening ration the cost will be 4s. 10½d.—a saving of 1s. 1½d. per hen, or £56 5s. per 1,000 hens, or, roughly, 10 per cent. of the total feed bill.

This is one way in which the cost of production can be brought down, but there is yet another, and that is by careful feeding. On many farms there is undoubtedly a great wastage of food. One has only to visit poultry farms fairly continually to see feed lying about here and there—perhaps a little in each place, but amounting to a good deal in the course of a year. It might be averred that it is eventually eaten by the birds, but the experienced man knows that the greater part of the grain food thus left by the birds is eaten by sparrows, while the pollard becomes dried up by the sun until the poultry refuse to eat it, and eventually tread it into the soil of the yards. If 12s. is the cost of feeding hens under good management, what may it not be where waste is allowed?

Again, when the cost of feeding is abnormally high, many hens that might be profitable at other times fail to return even the cost of their feed, let alone yield a profit. These are small matters that have a tremendous bearing upon cost of production, and poultry-farmers must lower the cost of production or few will survive.

When Pollen is Scarce.

The suggestion was lately made that the problem for young beekeepers during periods of drought is not so much how to get honey as how to get pollen, and certainly under the adverse conditions often experienced in many inland districts, the lack of pollen causes very heavy losses. Many apiarists in the last drought endeavoured to save their bees by feeding substitute foods. A suitable substitute for honey has been found in sugar syrup, but trouble came from feeding nitrogenous food, such as rye-meal, pea-meal, cocoa, &c., as a substitute for pollen. Such substitutes are valuable for a short period, but cannot be relied upon if the drought extends through the summer and autumn. The autumn is a period when young vigorous bees are necessary in the hive to carry the colony over the winter.

To minimise losses in bees during extreme conditions, three methods have been used with sufficient success to warrant mention.

1. During the first period of drought in summer pollen substitutes should be tried; small quantities of paste made of rye-meal or pea-meal, mixed with honey and fed inside the hive, should be given. Some apiarists prefer to feed the meal from trays about the apiary without mixing. Cocoa has lately come under notice and beneficial results have been reported by a number of apiarists.

2. If the drought conditions extend into the autumn, it will become a matter of preserving enough bees of sufficient stamina to carry the colonies over the winter, and to give a chance of recovery in the spring. If during progressive times the apiarist reserves a good number of combs which have pollen sealed under honey, then these can be distributed among the colonies, thereby giving a chance of a fair number of vigorous bees being raised, but pollen not sealed under honey deteriorates in value as a food.

3. The commercial apiarist should, if it is at all possible, take note of the flora, and if there is no promise of bloom, and it appears possible that the drought will continue, inquiries should be made with a view of finding a locality showing brighter prospects. The temporary removal of bees (usually toward the coastal districts) is the surest method available of minimising losses. Even late in the autumn, after all local prospect has vanished, a fair recovery can often be made in this way.—W. A. Goodacre, Senior Apiary Inspector.

Permits for Bee Ranges.

Occupation permits for the purpose of apiary sites and bee ranges are granted by the Forestry Commission in relation to State forests subject to certain conditions, rental, &c. The ranges embrace areas varying from one to three square miles, and the provisions under which they are granted preclude apiarists from being placed too close to one another. The Commission is willing to consider the interests of any apiarist adjoining a State forest, and it is always open to a bee-keeper so situated to apply for a permit over the adjacent State forest.

The issue of permits for bee-keeping on Crown Lands is a matter for consideration by the Department of Lands, which Department issues special leases for the purpose.

Orchard Notes.

JUNE.

W. J. ALLEN and W. LE GAY BRERETON.

PRUNING will be the main operation engaging the attention of the deciduous fruitgrower this month. We cannot go into the details of the subject in these notes, but a few hints will not be out of place. The pruner should remember that the first few years of the life of a tree are devoted to the establishment of a good framework, and he should have the design of the framework he is endeavouring to attain in his mind's eye. Such of the previous year's leaders should be retained as will best continue and multiply, the main limbs where necessary, and the remainder should be cut right out. A young tree will often throw over-strong laterals, which should also be cut right out, as laterals of this type will persist in growing, and will eventually make main limbs where they are not required ; whereas if such strong laterals are removed altogether, when the growing point is further removed from these positions, laterals of a lighter type will appear that can be retained and easily managed.

Generally speaking one is apt to retain too many leaders, and thus multiply the main limbs before there is sufficient space for them. Though these generally can be removed later without great injury to the tree, when the overcrowding becomes more apparent, it is a very undesirable practice in varieties of apples liable to woolly aphis, as the heavy cuts which the removal of established branches necessitates take a long while to callous, and during that time they become breeding grounds for the aphides. With apples liable to woolly aphis especially, one should aim at leaving no strong growths that are not required for the future framework of the tree. When the superfluous strong shoots are removed as yearlings, the wounds very quickly heal over and cause no more trouble.

By cutting rather hard the main leaders that have been retained, an ample supply of strong shoots (leaders) is produced, from which choice can be made the following spring and summer for the multiplication and extension of the main limbs which form the framework.

The severity of this cutting back depends on the strength of the previous season's leaders, and also on the development of the framework.

If, after the full framework has been developed, the lower portions of the limbs are good and stout and the tree is still making strong yearling leaders, these can, under most circumstances, be merely thinned out to the desired number and left untopped for a season or more. This will often allow a tree to settle into cropping quicker, and also lessen the work in the following year's pruning.

Even when forming the young tree, it is necessary to keep in mind its cropping habits, but as the tree approaches its bearing age it is obvious that this knowledge becomes the main factor.

Each variety has its peculiarity, and moreover, will vary under the conditions prevailing in different districts, and it is only by close observation from season to season that a grower can arrive at the best treatment for each variety in his particular locality. A keen observer will find the tree itself the best instructor. Beginners should obtain a copy of the Department's book on "Pruning," which goes into the matter fully and will assist them to make an intelligent study of the trees.

Some General Principles.

Peaches and nectarines crop on the previous year's growth, both on laterals and short spurs. The latter are really only very short laterals, and are more prevalent on the nectarine than the peach, though some varieties of the latter fruit develop them freely. The important point, however, is that both laterals and spurs are only good for one season; consequently the peach must constantly be making ample new growth if it is to carry good crops.

The apricot will crop on the previous year's growth, and many varieties also on a spur that lasts, or naturally renews itself, for more than one year. Generally the apricot spur does not last like that of the apple or pear. Some varieties under certain conditions, indeed, develop very few spurs, their cropping being chiefly on the previous year's laterals; in such cases the management is similar to that of the peach.

European plums mostly crop on a spur either direct on the main limbs or on the two year or older laterals. Here again the spurs on some varieties are only short lived.

The Japanese plums mostly crop on both the previous growth and on spurs. It is, generally speaking, an easy tree to manage, as not only do the spurs crop for several years, but they are also easy to renew as they become spent.

The cherry crops on spurs on two-year-old wood and older. On most of the more widely-grown varieties the spur is long lived, but the Early Lyons is a notable exception, and is also difficult to manage in the matter of renewals.

Apples and pears will often crop on the tip of the yearling shoot, but generally the spur on the two-year-old or older wood is depended on for the crop. Their spurs are mostly long-lived and not difficult to renew, with exception, of course, of when they become spent.

The quince crops on a shoot that starts that spring.

The persimmon also crops on a shoot that starts that spring. In this way it may be likened to the cropping of the grape.

Though the cropping wood of some classes of fruit is only good for one season and that of others is good for several seasons, still the pruner's duty in either case is each season to look after renewals of spent wood. The habit of the individual variety must be observed, and these renewals assisted. The best results are obtained by following the natural habits of the tree, only modifying these habits, perhaps by accelerating the renewals or perhaps getting them in parts of the tree more convenient for the grower. Due attention, too, in some varieties, must be given at the time of pruning to the reduction of the prospective crop.

But necessary as pruning is, one should never forget that either in the young or old tree it is only a link in the chain of orchard operations, and the results aimed at in pruning will not materialise unless the tree is thriving. It is only under exceptional conditions that the tree will thrive satisfactorily, unless the other operations are attended to thoroughly and at the right time

Spraying.

This month is a good time to spray with lime-sulphur or Bordeaux mixture for leaf curl of peach or nectarine. In fact, the application cannot be delayed on early blossoming coastal varieties, like Bell's and Edward VII.

There is a decided saving in material in spraying after pruning, and where pruning is not complete it could be delayed with the more normal varieties till next month. It should be borne in mind that the best results in the control of leaf curl of peaches have been obtained by spraying before the buds are swelling, and it is better to spray both peach and nectarine trees before they are pruned rather than delay the application too long.

Ploughing.

Where orchards have been ploughed in the early autumn and there has been little weed growth since, there will be no need to bother again about this operation till the spring. But where no autumn ploughing was given, the plough should follow up each section that is pruned and sprayed. Though there are obvious advantages in this ploughing following the pruning and spraying, it should be completed by the end of July, especially where there is a sown cover crop or many weeds. To avoid the risk attendant on postponing the winter ploughing it may be necessary to allow the operation to precede the winter pruning and spraying.

Planting.

The present month is a good time for planting deciduous trees, provided the land is in good condition and moist, but not too wet. Deciduous trees make root growth long before the top starts, and it is a decided advantage to have them planted so that the first root growth takes place after they are in their permanent positions. Do not plant the tree deeper than it stood in the nursery.

The budding and grafting should be done so that the union with most trees is a couple of inches above the surface, and with apples liable to woolly aphis five or six inches above the surface of the soil. The roots should be placed with a downward tendency; this is more easily carried out if the centre of the hole is kept high. The soil should be pressed down tight around the roots when filling in the hole.

A leaflet on laying-out and planting fruit trees may be had on application to the Under-Secretary and Director, Department of Agriculture, Sydney.

A GOOD ration for the production of milk consists of 40 to 50 lb. lucerne hay or chaff per cow fed morning and evening, the quantity being varied according to the amount of grass available and the size of the cow. In addition, at each meal 4 lb. bran, 2 lb. maize-meal, and 2 lb. oil cake might be given.—L. T. MACINNES, Dairy Expert.

Agricultural Bureau of New South Wales.

REPORTS AND NOTICES FROM BRANCHES.

NOTE.—While gladly publishing in these columns the views of members of the various Branches of the Agricultural Bureau, the Department does not necessarily endorse the opinions expressed.

Auburn.

The first annual autumn show was held on 23rd April, and as an initial effort was a decided success. The show was opened by the Mayor of Auburn, and the exhibits, which were of high quality, were judged by Mr. Finch. The principal prize-winner was Mr. F. S. Burns.

Bimbaya.

A discussion on the competitive farm trophies at the Candelo show took place at a meeting of this branch on 19th April. The arrangements for the annual picnic also came under review. Mr. J. Alcock made some references to the farmers' experiment plots (maize) on his farm, and invited members to call and see them.

Mr. E. Breakwell visited the district on 21st April, and delivered a lecture.

Grasses and Weeds.

Specimens of a number of varieties (including some undesirable ones) were exhibited. The lecturer said that certain essential principles should be observed by the dairy farmer if he was to get the best out of his land. These were :—(1) Variety of pasture; (2) subdivision of paddocks; (3) sowing of fodder crops to supplement pastures; (4) suppression and eradication of weed growth.

The best balanced ration for dairy cattle was a combination of grasses and legumes. For example, a mixture of Sudan grass and lucerne had proved to result in a considerable increase in the milk flow, as compared with grass alone or lucerne alone. The carbohydrates of a grass should be combined with the protein of the legume. Failing lucerne, leguminous feed was well provided for by clovers. This district was well favoured as to grasses suitable to the conditions, and there was no reason why different pastures could not be laid down in different paddocks. For example, there was the combination of paspalum and white clover as a summer pasture, or such grasses as kikuyu, Rhodes, and Sudan grass. For the cooler seasons such grasses as cocksfoot, giant fescue, *Phalaris bulbosa*, perennial rye, tall oat, and clovers such as Bokhara, Chilian and cow grass were suitable. A winter mixture which would give good results was 5 lb. *Phalaris*, 6 lb. cocksfoot, and 4 lb. Bokhara clover per acre. Alternative mixtures would be—12 lb. cocksfoot, 10 lb. perennial rye, 4 lb. cow grass clover per acre; or 10 lb. giant fescue, 4 lb. tall oat, 6 lb. perennial rye, and a few pounds of red clover per acre. He strongly advised farmers not to sow paspalum on the good alluvial flat lands, as they could be better utilised growing summer crops.

Mistakes were often made in overstocking or overgrazing pastures in their first stages of growth. A light feeding off was necessary, but it should not be overdone in the first year of growth, as the root system was not firmly established. Again, the pastures should be allowed to seed at periodical intervals, and this could not be done unless there was subdivision of paddocks, enabling each portion to be rested in turn. Over and over again it had been shown that dairy cattle responded to a change of pasture. Yet many farmers kept to the same old feed in the same old paddock.

Sometimes winter pastures failed, and it was advisable to supplement the pastures with cultivated crops—oats, wheat, field peas, &c. He thought much more could be done by sowing a strong growing clover like berseem with a light sowing of oats, as it was extremely nutritious, enriched the soil, and stood a fair amount of cutting.

Then the conservation of fodder in the form of ensilage was extremely helpful, and in a district where sorghum and maize grew to perfection, the building up of reserves of food for dry times was an easy matter. The importance of keeping the pastures free from weeds was also pointed out in some detail.

Borenore.

On 19th April, Mr. E. Breakwell, Agrostologist, delivered a lecture on weeds and grasses.

During the day Mr. Breakwell had made a collection of some of the weeds and grasses of the district, and these were labelled and fully described at the lecture. The worst weeds seen were false star thistle or St. Barnaby's thistle, Boggabri weed, stinking fat hen, Aaron's rod (wrongly called by many farmers wild tobacco), prickly lettuce, docks and sorrel, wild black currant, and wire or hog weed. Borenore could be classed as a fairly clean district, due probably to the thorough cultivation orchardists gave their land, but the roadsides still grew thistles in abundance.

There was great scope for improvement in the pastures of the district. Many of the native pastures contained too large a proportion of such grasses as wild sorghum, kangaroo grass, bearded grass and others. Where the native pastures consisted of such excellent grasses as wallaby or white top (*Danthonia*) and paddock love grasses they need not be disturbed, but when composed of the coarser grasses, much better results would be obtained by ploughing them up and laying down to good introduced grasses.

A splendid pasture, judging by results obtained on a small scale by Mr. Henderson and others, would be a mixture of *Phalaris bulbosa*, Bokhara clover and cocksfoot. *Phalaris bulbosa* was the best winter grass he had seen growing in this district, and grown with Bokhara clover it would provide an ideal balanced ration. In growing cereal hay crops farmers would be well advised to try mixing about 12 lb. of Italian rye grass per acre with the oats or wheat. This grass, besides improving the quality of the hay, provided aftergrowth and good feed well into the autumn of the following year.

Regarding summer grasses, there were great prospects for elephant grass and kikuyu grass. Elephant grass stooled well and gave good feed. Kikuyu grass ran along the ground and succeeded in smothering summer weed growth. The Secretary, Mr. Henderson, had agreed to co-operate with the Department of Agriculture in growing promising grasses and clovers for the benefit and education of other farmers. Sudan grass had not given the same results as in previous years. This was undoubtedly due to the cold wet conditions which prevailed in December, as it was a grass that never recovered when the soils became cold and wet. In an ordinary season, however, it could still be strongly recommended.

Attention was drawn to the necessity for subdividing pastures and resting them occasionally in order to allow them to seed and thicken up. He also mentioned the possibilities of Shearman's clover in wet situations, Ladino clover (an improved form of white clover), and a perennial strain of prairie grass.

Coolah.

Mr. J. N. Whittet, Assistant Agrostologist, visited this centre late in the month of February and having inspected a number of crops of lucerne in connection with a local seed-growing competition, delivered a lecture on the subject of lucerne. A report on the seed-growing competition appears elsewhere in this issue.

Mr. Whittet confessed himself surprised at the manner in which lucerne thrived at Coolah, and anticipated a time when the district would be classed with the better-known parts of the State for its lucerne. There was a good demand for seed of good quality, but Coolah growers should cultivate a market. Already the majority of their seed was going to Melbourne, but although that was satisfactory it was not gaining them the name in their own State that they deserved, and they should consider that.

The soil in the valley readily formed a fine mulch, and only good methods were necessary to get a good stand. The value of top-dressing with 1½ cwt. to 2 cwt. superphosphate was emphasised.

The time to cut for seed was when the majority of the pods were yellow, germination tests having shown that the yellow seed came away better than the seed cut earlier or later. The cocks made in handling should be small and the handling, altogether, as little as possible.

Cooper's Shoot—Broken Head.

A branch has been formed at this centre, the first meeting being held on 23rd April, Mr. John Wright presiding, and Mr. J. P. Martin being appointed Hon. Secretary. Arrangements were made for the advantage of members in several directions. The chairman remarked that the class of member desired was the one who was out to learn all he could about his branch of primary production.

Cotta Walla.

A meeting was held on 18th April, when a recent demonstration of the use of explosive was discussed, and the question of the co-operative purchase and storage of explosives for the convenience of members was considered. The subject of handling farm horses was also usefully discussed.

Dapto

A discussion took place at a meeting on 21st April on the means by which fertility might be restored to an impoverished soil.

Mr. W. T. Harris, who led the discussion, said that the absence of clover and rye grass was evidence of depreciation in the fertility of local soils. Green fodder crops also withdrew plant food from the soil, and it was felt that the time was coming when steps would have to be taken to improve the soil. There was a great waste of farmyard manure, which should be used to better advantage. It was wise to harrow manure in the cattle camps, after a light seeding of grass in the autumn Artificial manures were also profitable, and he advocated their use in connection with crops, but in stricter relation to the soil he advocated the use of farmyard manure. Underground drainage was useful for taking off water that caused the ground to become waterlogged Pipe drains were the cheapest in the end, as they involved far less labour. Surface drains were only for flood waters.

Mr J. J. Cook was a firm believer in bonedust in preference to other manures

Mr. J. Stevenson remarked that the manure of cattle fed on bran was far superior to that of cattle on other feeds, which seemed to him good reason for an increased use of bran. He advocated the growth of leguminous crops to improve the soil.

Mr. Harris believed in the continuous cultivation of the same paddock, but this was not approved by several members, who considered cultivation paddocks should be sown with grasses at times, and other paddocks cultivated.

Glenfield.

There was a large attendance for a lecture by Mr. J. Hadlington, Poultry Expert, on 12th April, the subject being the selecting and mating of poultry. The types of bird to be preferred were indicated by lantern slides, as also those that should be rejected, and a valuable portion of the evening was devoted to the answering of questions.

Glenorie.

A meeting was held on 16th April, when a discussion took place on die-back in citrus trees, several members detailing their experiences. The formation of a local co-operative society and erection of receiving depôts were considered, a committee having been appointed by the District Council.

The branch met again on 30th April, with a good attendance. Arrangements were advanced for an early pruning demonstration by an officer of the Department of Agriculture.

Delegates who attended a meeting of the Metropolitan branch reported on the demonstration and testing of canned fruit conducted at the meeting, and it was felt the information obtained was so useful as to justify the selection of delegates for each meeting of the Metropolitan branch.

Protest was expressed at the proposal to transfer the title "Great Northern Road" from the existing road to what is known as Marouta road (*via* Windsor), the effect of which would be to divert northern traffic from the main and most direct road.

Kellyville.

Members of this branch met on 9th April, when a paper was read by Mr. H. Firth on lime and its uses on the farm.

Lidcombe.

At the last meeting of this branch papers were read by Mr. J. F. Hillson on manures and fertilisers, and by Mr. Lunney on the chemistry of soils and manures. The latter paper dealt with the history of the formation of soils from the rock, and also discussed the chemical and biological changes brought about under various conditions.

The following paragraphs are from Mr. Hillson's paper :—

The Use of Manures and Fertilisers.

We sometimes hear the question, "What manure should I use for maize," or some other crop. The question cannot be properly answered unless we have some knowledge of the locality, and the class of soil it is intended to grow the crop in. To give an instance. Up near the border, a crop of maize was grown on land that had been in cultivation for over fifty years, and never manured. The crop was grown by a man whose grandfather used to grow maize there. The crop yielded somewhere between 50 bushels and 100 bushels to the acre. Now, if we tried to grow maize on some of the ti-tree scrub land of this district for five years without manuring, we would hardly get enough off it to feed a fowl. The winner of the sweet-pea prize last year at Sydney was quoted by the press as having used sulphate of iron with success. Another gentleman who also used it on his peas said there was practically little difference between those on which he used it, and those which were untreated. So, in using manures and fertilisers, we must use our heads as well as our hands, otherwise instead of getting larger crops we waste our money.

A man who has applied nitrate of soda or sulphate of ammonia to a crop of cabbage on land containing plenty of humus, finds his crop is a good one; having sufficient moisture, it has grown quickly. On clearing off the cabbage crop he plants, say, peas or beans, and again applies nitrate of soda or sulphate of ammonia. The result is, he gets plenty of haulm, but very few peas and beans. He would have done much better if he had used a little lime or wood ashes; or, in fact, no manure at all.

After growing cabbage or cauliflower, if I plant peas or beans, I use no manure of any kind. There is sufficient manure from the preceding crop.

There was a remedy printed in the press a short time back for tomato wilt. The writer stated that it was caused by poverty of soil; another grower stated it was caused by over-manuring. Well, my plants were raised in a hot-bed. I planted them out in land which had been used for cabbage nine months before; then a crop of peas was grown, after which the tomatoes were planted. A handful of wood ashes was given to each plant, and a very light dressing of lime scattered over the land was the only manure they received. I had a splendid crop of tomatoes, very few with wilt, and no black spot. A few plants I left in the hot-bed grew luxuriantly, having a dense mass of haulm and very few tomatoes and no wilt. "One swallow does not make a summer," but one trial convinces me that we must look elsewhere for the cause of wilt.

You must try out your own soil if you wish to know what manures it requires for the different plants you wish to grow. Have a trial patch, and use it for testing out the different manures on the plants you grow. This will in a measure prevent you from applying the wrong fertiliser.

Whatever the soil may be—clay or loam—we shall not attain the full benefit of any manure unless the land is in good tilth, well drained, and cultivated to a depth suitable to the crop we wish to grow. If we wished to grow, say, wheat, it would be a waste of time and money to make the land ready to the same depth as if we were making an orchard, or even a market garden, although in the latter case, a Chinese market gardener seems to be regulated by the length of the shovel blade. In wet weather in undrained

land, the plants will be waterlogged, and in dry weather with no cultivation they will be stunted. Fertilisers are much more efficient on ground that is in good tilth than on cloddy, poorly-prepared land.

When manuring land and calculating the amount to be supplied we should take into account the amount of organic matter turned under in the shape of grass or weeds. It has been proved that 80 lb. of meadow grass ploughed in is equal in virtue to 100 lb. of farmyard manure. My practice is to endeavour to return to the soil all the grass and weeds, as I consider by so doing I am supplying what the soil of this district requires—plenty of humus.

There is one kind of manure that we never seem to get too much of, and which I am afraid we do not give sufficient time and attention to. I speak of what is called a compost heap, or, what would be better, a pit, so situated that surface water will not run into it, but yet so that the contents of the pit will not become dry or burn. This heap or pit should be made up with all the waste of garden, trees, and house, and is much improved by having the waste water and slops from the house thrown over it. If you have a hole dug so that the drainage runs into it, so much the better; you can then utilise the liquids in the making of liquid manure, or throw it back over the heap. Should the pit or heap smell strongly, ammonia is escaping, and by mixing some gypsum with the top layer the smell will disappear, or become what is called "fixed," the ammonia which was escaping being converted into sulphate of ammonia.

I gave sulphate of ammonia a thorough trial on a large patch of onions this season, on loamy soil. One part was treated with sulphate of ammonia and the other left untreated, but both parts were well manured with fowl and cow manure. About five or six weeks after planting out the onions, I commenced using the sulphate in liquid form, one tablespoonful to three gallons of water. The rows were 15 inches apart, and to ensure an even spread, and yet keep it off the plants, I made a spreader for the water can, which caused it to spread out to a distance of about 10 inches. One can was made to do one row, and an application was made once a week until the onions had bulbed, always making sure the soil was not in a dry state. The treated plot had far and away the best bulbs.

In my opinion, the reason why some fail in this, as well as with other fertilisers, is that they think if a little is good, more will be better still. It is useless mixing a certain quantity of a fertiliser with a given quantity of water, and then pouring it over a small portion of land. Nitrogen over-supplied in any form is more likely to do harm than good.

Lower Portland.

This branch met on 14th April, when the judges for the show were appointed, and other arrangements made for the event. It was decided to stage an exhibit at the Hawkesbury show.

March.

This branch met on 27th April, when members discussed with satisfaction the success of their exhibit at the recent Orange show, where the first prize was obtained from among four competitors.

Points were noted, and matters arranged in a preliminary way for the display to be staged at the 1922 Orange show.

Milton.

A meeting was held on 19th April, when Mr. A. A. Smart read a paper on the cultivation of lucerne, and thus initiated an interesting discussion. The following paragraphs are from Mr. Smart's paper:—

Lucerne Cultivation.

The importance of this forage plant to the farmers and graziers of Australia cannot be over-estimated, and fortunate indeed are they who possess soil and climate favourable to its healthy growth and perfect development. I have no hesitation in stating that land capable of growing this most valuable plant is worth pounds per acre more than the land not suited to it. Lucerne has been said to be the most valuable of all fodder crops for a drought. It can be used for green fodder or silage, or it can be made into hay. Lucerne prefers a deep, well drained, calcareous loam, where it can send its roots deep down into the subsoil, out of reach of drought. It will keep green and luxuriant during the hottest months of summer, and is always ready to respond to a genial summer shower, or to irrigation.

There are three conditions under which lucerne will attain great perfection in this district. First, when the roots of the plants can penetrate to the natural water; second, when the soil is a friable loam, and the subsoil is of a fairly retentive nature, holding moisture during the hot and dry summer months; third, when irrigation can be applied.

The value of irrigation for producing heavy crops of lucerne in many parts of Australia cannot be over estimated. Lucerne will last from seven to twenty years in this district, and I have cut it from three to six times per year, and have made from four to seven tons of hay per acre per year. In preparing the soil for lucerne, the ground must be ploughed deeply, and three crops taken off before it is sown with lucerne. It is then ploughed, harrowed, and rolled, and the seed sown. One stroke of a very light harrow is sufficient to cover the seed, and then the land should be rolled again. Many seeds are buried too deeply and never germinate, and the seedsmen are blamed for sending inferior seed. From a quarter to half an inch of covering is sufficient. It is difficult to sow small seed like lucerne by hand evenly; the seed will slip through your fingers in spite of the greatest care, and the sowing will be irregular. It is impossible to throw small seeds any great distances. Some people advocate drilling, but from my experience of over twenty years, I am of opinion that broadcast sowing is to be preferred.

It is not advisable to break up virgin soil and sow lucerne as a first crop. A preparatory crop of cereals and then a root crop is most desirable. The best time to sow lucerne in this district is after the first autumn rain, say, March or April, while the soil is warm and moist. The quantity of seed to sow per acre is from 14 lb. to 17 lb., according to the germinating power of the seed. No heavy stock should be put on lucerne the first season after sowing. A mowing machine should be run over it when it becomes spindly, and it will branch out splendidly. At no time should it be eaten down too close, for lucerne rebels against being continually nibbled at. As soon as the crop has been eaten down it has a tendency to throw shoots for the next crop.

There is no doubt the best results can be obtained by cutting lucerne on what is known as the soiling system. As the word "soiling" is not generally understood among our young farmers, a little explanation may not prove out of place. Soiling really means cutting and carting the fodder to the animals. Several advantages are claimed for this system. First, that a given area of land will carry more stock; second, that more actual food will be produced from such crops as lucerne; third, that the food grown is more fully utilised; fourth, that milch cows thrive much better and produce more milk. Lucerne is a leguminous plant, and it obtains most of its nitrogenous food from the atmosphere. Potash, phosphoric acid, and lime are the principal constituents taken from the soil; this being so, I would recommend a dressing of good superphosphate, 2 cwt. per acre, and kainit, 1 cwt. per acre. A top-dressing of gypsum is beneficial later on.

It is well known that there is no difference botanically between various types of lucerne, although there is a difference in appearance. Some years ago I sowed some colonial seed of lucerne and some American seed. It was sown side by side under similar conditions. All came up well, and during the first season very little difference was observed, but during the second season the difference was very marked indeed. The produce of the colonial-grown seed was a foot higher, and yielded 100 per cent. more fodder than the American seed. The product of the colonial seed was of a robust growth and broad leaves, showing great vigour; the American article was puny and delicate, very fine and small.

A good stack of lucerne hay, to tide over the severity of a drought or of winter, would be invaluable. What can be healthier or better for stock that this product? It is so easily grown and handled. A few acres well attended can be cut three or four times a season, and a good stack obtained. It is well known that cows fed on green lucerne develop tainted milk, but the cream can be pasteurised, and this will get rid of the tainted flavour. In hot weather cows should not be left longer than fifteen minutes in a lucerne crop while it is in succulent growth, or they will develop hoven. In cold weather they may be left a little longer. Lucerne is the kindest of all crops, and every farmer should grow from 2 to 5 acres or more. I do not know of any farmer within a mile or two of Milton who has not got some land that will grow lucerne. There are hundreds of acres of suitable land in the district if properly cultivated, and I hope in the future more farmers will try an acre or two for experiment. With proper cultivation and handling I have no fear about it being a success.

DEPARTMENTAL NOTE.—The Chief Inspector of Agriculture in commending this very practical paper, remarks that the Department's experiments have shown that top-dressing with 2 cwt. of superphosphate is valuable, and no other fertiliser or mixture is so profitable. Farmers should test it in small areas on their own farms before trying it on a larger scale.

Mittagong.

The branch met on 23rd April, when a discussion took place on the means by which local interest in the Bureau could be increased; those present evinced confidence in the usefulness of the institution.

General satisfaction was expressed at the branch's success at the Moss Vale show, where the shield for the best Bureau exhibit was won. It was agreed to ask other branches in the Berrima district to attend a joint meeting to deal with matters for next year's show. A better method of judging the exhibits was considered desirable.

A series of lectures has been arranged for the winter months, and it is hoped the branch will become a power for good in the district.

Moss Vale.

The monthly meeting was held on 18th instant. The programme for the year was prepared, and it is hoped that one or two lectures and demonstrations will be given by officers of the Department.

It was agreed to apply to the Department for seed of different varieties of wheat, oats, barley, and rye, to be sown by several members who were prepared to give them special attention, and to harvest them for exhibition at the next local show.

Mullumbimby.

A meeting was held on 22nd April. Several members promised papers if the Bureau leaflet suggested by the Department was started. An interesting paper on banana-growing was read by Mr. J. J. Stewart; a portion of this paper follows. A discussion also took place on the growth of sweet potatoes. The branch is representing to the Department the importance of soil analysis on the banana plantations of the Tweed.

Banana-growing.

My eldest son and I commenced planting bananas in November, 1913, on our farm on Mullumbimby Creek. The land is very rough and steep, but it proved to be an ideal place for banana-growing, as the soil is fairly good and the aspect is the right one, being north-east. We started planting without any previous experience, only knowing what we had read in pamphlets on the subject. However, we happened to strike the right method, as after experience proved.

The first thing we did was to brush, burn off, and clean up the portion we were going to plant, about 1¼ acres, as we did not know if the land was suitable for banana culture. With the clearing finished, we commenced to dig the holes for the plants. We dug them about 14 inches by 12 inches, with 12 feet between the holes, and planted the suckers about 9 inches deep, and we have kept to that system ever since, and found it very good. The suckers we used then were largely composed of pieces of old corm with sprouts on them; others were only about 6 inches to 9 inches high, and a good many were very small. We found the piece of corm produced the best stalks and bunches, and the small plants produced much better bananas than the larger ones about 2 feet high. After the planting is finished the next thing is to keep the hoes going among the young plants. We have found that it is absolutely necessary to keep the young plants thoroughly chipped; for the first twelve months, at least, the more chipping the better the crop has been our experience.

The next thing is to know when and how to cut the fruit. We have found that the fruit takes about four months in summer and five in the winter after the bunch is fully out before it is matured. We generally leave the bunches until the sharp angles are gone, and the fruit is nice and round in appearance. We have also found that cutting off the flowers after the bunch is fully out is a mistake. We leave them to decay gradually of themselves, and by doing so we get much better bottom hands; this method also does away to a great extent with the "noblings" or small bananas at the bottom of the bunch.

The next most important thing is the packing, and how to place the fruit successfully on the market. We have tried various methods of packing, but we have found that the cross-packing is the best for the Sydney market. This consists of placing the bananas across the case in threes, four, and sixes, as the case may be, putting as few single bananas in the case as possible, and only when it is necessary to fill up the centre of the case, if the bananas should not be long enough to meet and go down the corners. We always pack a little higher than the case, to allow for shrinkage, and we find that our case opens up in good condition, as is proved by the fact that we have been getting the average top market prices since we started the business.

De-suckering, or cutting out the surplus plants, we have found to be the most important and most difficult work on the plantation; it can only be mastered by experience. We have found that the best plants to leave to form the stool is the one furthest away from the parent stalk. We have found that the best way to get good fruit is only to allow the original plant and two suckers to grow during the first year if the soil is fairly good; in poor soil one sucker is all that should be left.

The second year one more stalk may be left. We have found that from four to five stalks is the best number to have in the permanent stools; sometimes they exceed that number, to the detriment of the fruit.

We have had no diseases until about a year ago, when "bunchy top" began to make its appearance. We have been cutting the diseased plants out as we found them, until the sulphur treatment was discovered. We have been treating "bunchy top" with the sulphur, but we have not yet had sufficient time to know the result. However, sulphur seems to be proving effectual on some plantations on the Tweed.

We have found that we have got better returns from an acre of bananas than from any other crop we could have grown, and, taking them acre for acre with dairying, they can beat it by a good margin.

We have no hesitation in stating that if anyone can get a suitable piece of land with good soil, the right aspect, and well sheltered from the west and south winds, with good attention to all the details of the culture, banana-growing can be made a very successful industry.

DEPARTMENTAL NOTE.—The Fruit Expert remarks that the practical experience related in this paper is of the greatest interest, but it is too early to deduct anything from the use of sulphur for the control of bunchy top.

North Berry Jerry.

The monthly meeting was held on 25th April. A good deal of interest was taken by the meeting in the Coolamon A. and P. Society, and the members were sympathetic with an effort to place that society's show on a sound footing. It was felt that there was scope in the Coolamon district for live branches of the Bureau.

Among other matters discussed were needed repairs to the roads in the vicinity, the location of the captured gun that had been allotted to the district, and the erection of a memorial hall.

Oberon.

At a meeting held on 2nd April papers on pea-growing were read by Messrs. G. W. Kelly, S. Badcock, and F. Wilson. The papers are summarised in the following:—

PEA-GROWING.

Mr. G. W. KELLY.—In the Department's experiment plots, two-thirds of an acre was sown on 23rd December, 1920, as a trial for varieties and manure.

Hundredfold was an early dwarf variety that matured in sixty days on 23rd February. Its yield was low, viz., 44 bushels per acre. It was a light green colour, and not a good seller.

Richard Seddon was sown and pulled on the same date as Hundredfold. It yielded 56 bushels per acre, and was two or three shillings per bushel better in price. It was an early variety and well worth a trial.

American Wonder yielded 68½ bushels per acre. It was one of the best sellers, but was a little late, being pulled on 2nd March.

William Hirst yielded 72 bushels per acre. It had a longer pod; was a dwarf variety.

Nottingham Defiance yielded 120 bushels to the acre, and was pulled on 9th March. It was the best yielder, and was a cross between the Green pea and Stratagem.

Stratagem was a good colour, but was large and soft, and was not a good market pea.

Green pea yielded 75 bushels per acre, and was pulled on 8th March. It was a good seller, but the yield was not so good. Every pod was filled from end to end, and was a good colour.

Yorkshire Hero was used for manure tests. These were pulled on 2nd and 10th March, and the results were :—Superphosphate, 2 cwt. per acre, 112 bushels per acre; P 7, 96 bushels per acre; no manure, 85¾ bushels per acre; P 5, 114 bushels per acre. This last manure is more expensive and contains potash. Ten plots averaged 84 bushels per acre. The land had been cultivated for twenty-five years, and for the last fifteen years had been growing rye.

The seeding was rather light—64 lb. to the acre. The seed did not germinate very well, which accounts for the yields being small.

In answer to a question, Mr. Kelly did not think there was any danger to the plant if manure up to 4 cwt. per acre was used. The stalks made excellent feed for milking cows.

Mr. S. Badcock.—He found green seed the best. He had planted English Wonder, which came up in nine days, and Yorkshire Hero seed, which was dried white, and only about one-half came up in fifteen days. He planted seventeen rows 100 yards long.

Yorkshire Hero yielded 28 bushels, and sold at 9s.; English Wonder yielded 21½ bushels, and sold at 16s. per bushel.

He left 2 feet between the rows so as to use the scarifier. He found 1¼ bushels per acre was sufficient. If 2 bushels were sown the growth was too thick and the pods did not grow as long and did not fill out. He planted 4 inches deep this year, but if wet he would plant 2 inches. He saved the stalks of 3 acres of Yorkshire Hero, and the cows preferred it to wheaten hay and milked better on it. He ploughed six months before sowing and fallowed, and then three weeks before sowing he ploughed again.

His crops averaged 84 bushels to the acre, at 10s. per bushel.

Mr. F. Wilson.—He had ploughed up ground 9 inches deep, but had brought up the subsoil and spoilt the ground for potatoes. He had obtained at the rate of 204 bushels per acre by planting double rows 8 inches apart and 2 feet 6 inches between each double row.

Dwarf Champion grew 18 inches high, and yielded better than Yorkshire Hero, and sold 1s. a bushel better.

Mr. Gilmore said a friend of his at Lowther had a machine for planting peas in double rows.

At a meeting on 21st April, Mr. W. Franklin was elected Chairman, and Messrs. J. P. Ryan, G. W. Kelly, J. Gilmore, S. Badcock, and F. Humphries, were elected a committee, with Mr. C. S. Chudleigh as Hon. Secretary. A series of rules was submitted to the meeting. Mr. G. N. Falls offered a prize for the best sample of Early Rose potatoes, to be judged at next meeting. Mr. G. A. Batchelor made a similar offer in respect of Satisfaction, and Mr. Franklin the same for Manhattan, the competitions to take place at succeeding meetings.

A paper was read by Mr. J. Gilmore on potato-growing. A summary follows :—

Potato-growing.

The three most important things for success were :—(1) Clean seed; (2) good marketing varieties; (3) good ground.

The seed should be selected when digging the previous crop. It becomes difficult to judge varieties when the skin is faded. Varieties received from merchants could not always be depended on. A variety was running out when the eyes became larger and the flesh yellow or red. He had seen quite different varieties of seed sold as the same kind, and advised beginners to get someone with experience to choose for them. Nothing smaller than a hen egg was the best for seed. Large potatoes cut sometimes missed in dry weather and sometimes rotted in wet weather. He would select the good shaped ones when digging once in three or four years, and sow in a special place for seed purposes.

Small potatoes were sometimes run out and these would produce only potatoes of seed size. Cut potatoes should be left a day or two in the sun scattered about, not stacked in heaps, or they might heat.

Mr. Gilmore always believed in the red skins, as the white kinds were hard to sell. Early Rose was always marketable. He had grown 15 tons to the acre on chocolate

soil between the slate and granite country. He had grown crops three years in succession from the same ground, and then by fallowing in alternate years, for another six years. If the soil is stiff it should be worked between the rows until the stems are too big.

Penrose-Kareela.

At the monthly meeting, on 11th April, formal business was transacted, and some of the exhibits and awards at the Sydney Royal Show were discussed.

Stratford.

On 16th April Mr. Miller gave an interesting demonstration of tomato culture, producing specimen plants and showing how they should be pruned. He believed in pruning and trellising to get the best results. The soil on which the plants were grown was of very poor quality, being a very stiff clay, but Mr. Miller used artificial fertilisers liberally, and one plant had reached a height of 12 feet, and had borne fruit of excellent quality.

Sydney (Metropolitan).

A largely-attended meeting of this branch took place on 27th April, when Sir Joseph Carruthers presided. Cinematograph pictures were shown, supplemented by addresses by Messrs. W. S. Campbell and H. E. Laffer, on vine growing and wine making. A demonstration and test of canned and dried fruits was also conducted, and the whole evening was regarded as a very valuable and propitious one.

Tahmoor.

The inaugural meeting of this branch was held on 14th April, when the following officers were elected:—Chairman, Mr. G. R. Stewart; Vice-Chairman, Mr. W. A. Miller; Treasurer, Mrs. E. Paterson; Joint Hon. Secretaries, Messrs. A. G. Miller and A. Crane. Meetings will be held monthly, and the subscription has been fixed at 2s. 6d. per annum.

Tennyson-Kurrajong.

The monthly meeting was held on 4th April, when Mr. V. S. McMahon gave an address on pea-growing in the Kurrajong district. Though not posing as an expert, he grew 70 acres annually. He had given nearly every sort a trial, and had found Yorkshire Hero the most suitable for the district, and placed Senator, Greenfeast, and Wonder, in that order. He advised sowing from the middle of April for autumn and winter peas. The picking would last from May to September. The drills should be run from east to west; seed 1 or 2 inches apart, and drills 3 inches deep. He sowed 1 bushel per acre of a small variety, and 1½ bushel of larger sorts, using 5 cwt. of manure (preferably bonedust) per acre.

Thyra-Bunaloo.

The monthly meeting was held on 16th April. A discussion took place on the weed stinkwort, which is beginning to invade the district from Victoria.

Toronto.

At a meeting on the 12th April, Mr. H. Filmer afforded interesting information on spraying citrus for white wax and red scale.

It has been decided to form a ladies' committee in connection with this branch.

Wallsend.

At a meeting on 18th April, the greater part of the evening was spent discussing the commencement of a wholesale purchasing department, and efforts are being made to secure the co-operation of other branches in selecting one buyer for members.

Warrah Creek.

The branch at its meeting on 21st April decided to endeavour to obtain an acre of land for the erection of a sheep dip on the Warrah Creek Reserve, the settlers to do the work themselves. An effort is also being made to secure the establishment of farmers' experiment plots in the district. The branch has also interested itself in local roading, the recreation ground, the erection of a local hall, and the proclamation of stinkwort as a noxious plant.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1921.

Society.	Secretary.	Date.
Murrumbidgee P. and A. Association (Wagga) ...	A. F. D. White ...	Aug. 23, 24, 25
Forbes P., A., and H. Association	E. A. Austen ...	,, 23, 24
Corowa P., A., and H. Society...	J. D. Fraser ...	,, 30, 31
Grenfell P., A., and H. Association	G. Cousins ...	,, 30, 31
Young P. and A. Association	T. A. Tester ...	Sept. 6, 7, 8
Albury P., A., and H. Society	A. G. Young ...	,, 6, 7, 8
Gunnedah P., A., and H. Association	M. C. Tweedie ...	,, 6, 7, 8
Hills District Fruitgrowers' Association (Galston) ...	B. F. Renant ...	,, 10
Cowra P., A., and H. Association	E. P. Todhunter ..	,, 13, 14
Cootamundra A., P., H., & I. Association	C. H. Inson ...	,, 14, 15
Northern A. Association (Singleton)	J. T. McMahon ...	,, 15, 16, 17
Holbrook P., A., and H. Society	J. S. Stewart ...	,, 20, 21
Temora P., A., H., and I. Association	A. D. Ness ...	,, 20, 21, 22
Henty P. and A. Society	H. Wehrman ...	,, 27, 28
Junee P., A., and I. Association	T. C. Humphreys..	,, 27, 28
Murrumburrah P., A., and I. Association	W. Worner ...	,, 27, 28
Deniliquin P. and A. Society	P. Fagan	,, 28
Hay P. and A. Association	C. L. Lincombe ...	Oct. 5, 6
Narrandera P. and A. Association	W. Canton ...	,, 18, 19
Tweed River A. Society...	T. M. Kennedy ...	Nov. 16, 17
Lismore A. and I. Society	H. Pritchard ...	,, 23, 24

1922.

Society.	Secretary.	Date.
Kiama A. Society...	G. A. Somerville...	Jan. 25, 26
Shoalhaven A. and H. Association	H. Rauch ...	Feb. 8, 9
Guyra P., A., and H. Association	P. N. Stevenson...	,, 21, 22
Newcastle A., H., and I. Association	E. J. Dann ...	,, 22 to 25
Tenterfield A. Society	E. W. Whereat ...	,, 28 and March 1, 2
Berrima District A., H., and I. Society	W. Holt	,, 2, 3, 4
Glen Innes P. and A. Society	Geo. A. Priest ...	,, 7, 8, 9
Campbelltown A. Society	J. T. Deane ...	,, 10, 11
Tamworth P. and A. Association	F. G. Callaghan ...	,, 21, 22, 23
Hunter River A. and H. Association (Maitland) ...	E. H. Fountain ...	,, 22 to 25
Camden A., H., and I Society	C. C. Irving ...	,, 23, 24, 25
Royal Agricultural Society of N.S.W.	H. M. Somer ...	April 10 to 19

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Agricultural Gazette of New South Wales.

Wheat-growing in New England.

R. H. GENNYS, Manager, Glen Innes Experiment Farm.

THE conditions governing the production of wheat on the Northern Tableland differ considerably from those in the rest of the State. The climate is cooler and the rainfall heavier and more reliable than elsewhere, while the soil is of a heavier nature and chiefly basaltic, though volcanic ironstone also occurs. The cooler temperatures necessitate the use of hay on a larger scale for the feeding of stock than in the warmer districts, and wheat is so suitable for this purpose that quite half the area sown to that cereal each year is cut for hay. Under the influence of changing conditions, however, there are indications that wheat for grain may in the future prove a larger factor in farming in this part of the State than formerly.

The New England farmer requires to select his soil with some care for the different crops. Good hay crops are obtainable on almost any class of soil, though the darker and richer soils are perhaps the best, but for grain such land should generally be avoided, and preference be given to the lighter and red coloured soils. It has been observed that the head does not always fill well on the heavy soils; very heavy yields of straw are obtainable, but even in the shorter crops the heads do not always fill well.

In one respect the New England farmer enjoys a distinct advantage over his western compeer—he can adopt a rotation of crops that is profitable at each course, and yet practically complete. The western grower is distinctly limited in the matter of profitable crops that can be alternated with wheat, but the New England farmer can adopt a rotation that in four years provides three grain crops, a fodder crop, and a fallow. The course consists of :—

Maize or Potatoes—sown in October or November; harvested in June.

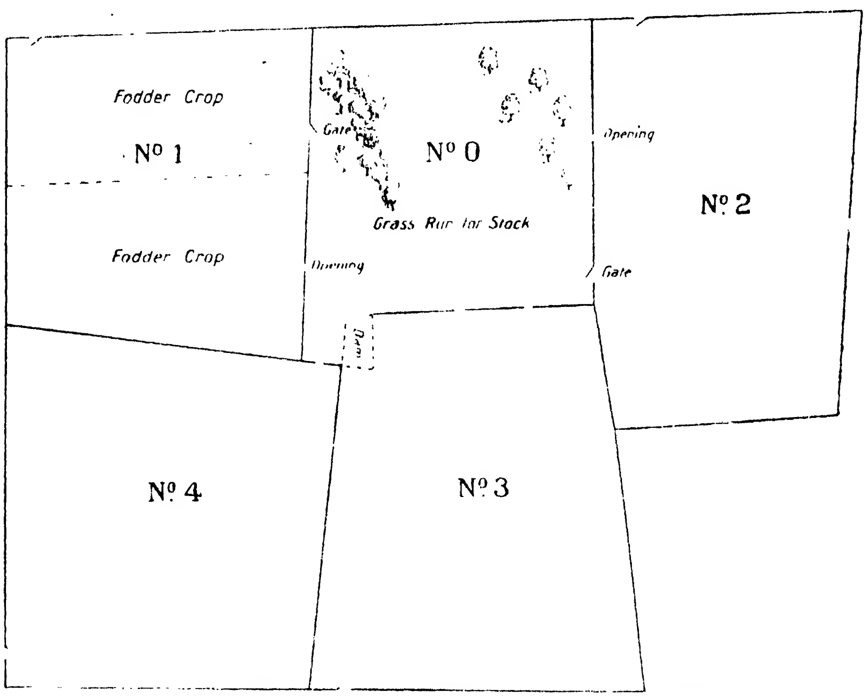
Wheat or Oats (quick-growing variety)—sown in July or August; harvested in December.

Fodder crop (rape or turnips in combination with a cereal, sown in February; or clover with an annual or biennial grass, sown in March or April); fed off with sheep, residue ploughed under in early summer.

Wheat or Oats (slow-growing variety)—sown in April; or medium slow-growing variety—sown in May or June; harvested in December; land fallowed in January or February in view of sowing maize or potatoes in the following spring.

Such a rotation carries its own recommendations, there being a sufficient variety of crops to maintain fertility, as well as provision for a flock of sheep on the farm. It should not be necessary in these days to commend to a wheat-grower the value of a flock of sheep. In every part of the State it is found that the combination is an invaluable one, and New England is no

exception. Some of the best crops obtained on Glen Innes Experiment Farm have followed the fodder crop, but sheep also turn weeds, self-sown wheat and stubble to account, and enable the farmer to make money out of what would otherwise be a source of trouble and expense. The accompanying diagram gives some idea of how, taking advantage of natural conditions, the paddocks are arranged for the rotation at Glen Innes Experiment Farm. It will be seen that the paddock No. 0 contains a dam to which access can be had from all the paddocks in the rotation area. Several acres of red gum scrub near the water afford protection for the stock from wind and rain in winter, and from the heat of the sun in summer. Suitable licks are



Plan showing the arrangement of Rotation Paddocks at Glen Innes Experiment Farm.

[The dotted line across No. 1 Paddock indicates a temporary fence.]

always available in the timber, and generally a straw stack for the stock to pull at; in lean seasons these stacks are invaluable, and even when succulent fodder is available they help to balance the ration.

The practice on this farm is to clear the maize stalks off, and plough the land at once, so as to get it into condition and enable the seed to be sown as soon as possible. It goes without saying that to sow wheat immediately maize stalks are removed would be impracticable in other districts, as the ground would be quickly dried out. The moisture conditions of New England enable it to be done, however, and done profitably.

The depth of ploughing for this sowing is usually 4 inches, and a method of preparing the seed-bed must necessarily be adopted that will conserve to the maximum the moisture left in the soil by the maize. Necessarily it is July or August before the wheat can be sown, but it is not too late for the district. As a matter of fact, visitors from other parts of the State are often surprised to see crops being sown on these tablelands as late as the beginning of September—a time when the coastal crops are ready for cutting, and when western crops are regarded as approaching maturity.

An early maturing variety of wheat must be used. Thew has been tried, but with only a fair amount of success on the Experiment Farm, and with farmers who are sowing late wheat crops in this district, Florence is becoming a great favourite. Any grower who is disposed to try some other variety should avoid rust-liable wheats, and all seed should be treated with bluestone solution as a preventive of bunt. Sometimes oats are sown instead, and then such a short-season variety as Sunrise or Guyra is used. Occasionally White Tartarian is sown, for though slower in maturing it is more adapted to late harvesting, and is cut in January or even in February

This late-sown cereal crop is used very much as the season directs. It is not so certain as the early sown crop, and it has more often to be cut for hay than for grain, but in some seasons excellent grain crops have been harvested.

This cereal crop is followed, as indicated above, by a fodder crop sown in the early part of the fall. Rape or turnips, sown alone or in alternate drills with a good stooling variety of wheat or oats, or perhaps with Cape barley, may be planted in February; another useful combination according to our experience on this farm, and of other farmers in the district, is red clover, in combination with Italian rye grass or some other annual or biennial grass; the seed is sown in March or April. The fodder crops are fed off through the winter, the sheep being turned in once, twice or more often as the growth permits, and if possible, some growth is left to be turned under with the residues in the early summer.

This gives a short period of fallow before the sowing of the long-season cereal crop of the rotation. Any weeds or other growth that appear are fed off prior to a second ploughing, about the early part of April.

The first ploughing, when the fodder crop residues are turned under, is usually a deep one—about 5 inches—while the second ploughing is a little shallower—not exceeding 4 inches. The sowing of the wheat immediately follows this second ploughing, a long-season or slow-growing variety being used. Haynes' Blue Stem is sown on the earliest paddocks, but Genoa has also done well on the farm if sown a little later. For New England conditions, in fact, Genoa may be considered a mid-season to late wheat, whereas Haynes' Blue Stem is a very late variety.

The last-named variety has been a useful one locally, but it may shortly be superseded by one of several varieties of long-season wheats that are now attracting attention in the experimental area. Though producing a very

bulky crop for hay, Haynes' Blue Stem has the fault that the chaff is so light as to necessitate the use of too many bags to the ton; moreover, the grain shells too freely.

While some of the Manitoba and other Fife wheats, such as Power's Fife and Marquis, have yielded well at times, here it has been found that, notwithstanding that they may be very strong when imported, the grain quickly deteriorates under local conditions, and in a few years their flour strength is no better—and sometimes worse—than the local varieties. Some imported varieties are uncertain yielders, for in some years they fill well and yield heavily, while in other seasons, without any discovered cause, large patches of the crops fail to set grain. Marquis gave good yields of hay and grain last season, and will be sown again this year in the commercial area. Rust-liable varieties, of course, will always have to be avoided.

The early-sown cereal crops are more certain than the late-sown crops that follow maize. In a dry season they have the advantage of a certain amount of moisture conserved in the soil by the short fallow, while in a wet season they are apt to make such heavy growth as to go down. The best grain returns are obtained from these early-sown crops, but good hay crops are also obtained from them. It will be seen that the farmer is practically assured of a profitable crop whatever the season may be.

The seed, which should be "bluestoned," is generally planted about 2 inches deep with the disc drill; on the whole, in this somewhat moist district, it can be a bit shallower than in very warm districts. The quantity of seed used varies with the time of sowing, and may be best indicated in the following table:—

	April.	May.	June	July.	August
	lb.	lb.	lb.	lb.	lb.
Haynes' Blue Stem ...	50-60	60-70	...	...	..
Genoa	...	70-75	70-75	...	...
Marquis	...	70-75	70-75	...	...
Florence	...	...	70-75	80	90

In all cases, if the crops are expressly intended for hay, the sowing should be a little heavier. As a rule it is not advisable under New England conditions to feed-off wheat, unless very prolific growth occurs early in the season.

Methods of Harvesting.

The methods of harvesting grain in New England are very different from those of the drier western districts. The straw is too tough to strip as the wheat of the west is stripped, and moreover, it is invaluable as feed for stock during the winter, and the dry spells that occur from time to time. Even dry stock have to be fed during such times, and the straw must be saved or losses are likely to be heavy. Thousands of livestock were lost in the last drought which could have been saved had the supply of straw been larger, and those farmers fared best who had kept stacks of straw and hay beyond all seemingly probable requirements.

The soil, too, is not even enough in quality for the stripper or combined harvester, and some patches ripen earlier than others, while heavy dews would often prevent operations until late in the day.

Hence it comes about that it is the older machinery—the reaper and binder and the threshing machine—that are used to deal with the grain crop, and though it must be admitted that the operation is a more costly one than highly specialised machinery has made it in the west, the larger yields and the greater value of the straw, make it worth while.

Taking the average season, wheat grown in New England will never have the milling quality of that raised in the drier districts, but there are not lacking indications that a larger area will be devoted to the crop in the future, and probably (as varieties and methods improve) with a wider margin in favour of the grower, and certainly with higher yields than the average of the State.

The stage at which wheat is cut is of considerable importance. The quicker grain ripens the better the flour strength: slow ripening produces a soft wheat of reduced value for milling purposes. Under New England conditions, cutting with reaper and binder, and allowing the grain to mature in the stook before threshing, actually aids the production of a better quality grain. It is preferred on this farm to cut the wheat in the dough stage, and allow it to "make" or mature in the stook, or the result is a far better milling wheat and an attractive translucent grain. Cutting with the reaper and binder actually favours some varieties of wheat. In other districts, for instance, Florence shells readily, because it has to be kept until it is dry enough to strip. At Glen Innes, on the other hand, it can be cut at a stage when it still holds its grain well, and allowed to mature in the stook, with the result that it yields very well. Others also of the varieties successfully grown in New England are liable to shell if left until dry enough to strip.

Bleaching is largely prevented by cutting with the reaper and binder, for wheat that is left until ready for the stripper is much more likely to be damaged in this respect.

The straw also is of much better quality when cut with the reaper and binder, for when ready for stripping it has become little more than fibre, whereas cut at an earlier stage it still has a good deal of nutriment in it, and is accordingly better feed for stock.

Four essentials to successful wheat-farming in New England may be mentioned :—1. Suitable soils ; 2. Suitable varieties ; 3. Sowing at proper times ; 4. Cutting the crop at the right stage.

The Cost of Production.

In presenting the following estimate of the cost of producing an acre of wheat under New England conditions, it may be pointed out that it is based on the experience of Glen Innes Experiment Farm and of farmers generally in the district.

Costs have not advanced in recent years in this district so much as in some other parts of the State. One or two factors of a specific kind have been

responsible for this. Ploughing, once done in New England with heavy single-furrow or double-furrow implements, is now being done with four-furrow implements on many farms. In part, this is due to the implements used being of lighter construction than formerly. Time was when a two-furrow plough was a very heavy thing indeed, and farmers hesitated to try a four-furrow one, but to-day better and lighter models of four-furrow implements hardly involve any more horse power, and farmers are more disposed to use them. Stump-jump ploughs are preferred in stony paddocks.

The depth considered essential to best results is also less than it used to be. It is now found that nothing is gained by ploughing too deep on the heavy clay soils of the tablelands. In other words, the use of better implements and methods has almost kept pace with the increase in the cost of labour in ploughing.

ESTIMATED cost of producing an acre of wheat for grain in New England—Estimated yield, 20 bushels.

	£	s.	d.
Ploughing, once (land previously under cultivation) ...	0	7	6
Harrowing, twice at 1s. 4d. per acre	0	2	8
Drilling	0	2	0
Seed, 75 lb. at 7s. 6d. bushel	0	9	4
Superphosphate, ½ cwt. at 7s. cwt....	0	3	6
Pickling seed at 4d. per bushel; 1¼ bushels per acre ...	0	0	5
Cutting with binder	0	3	2
Twine, 5 lb. per acre at 8½d. lb.	0	3	6
Stooking for grain	0	4	3
Carting and stacking	0	11	8
Bags, seven at 8s. per doz.	0	4	8
Threshing at 2s. per bag	0	14	0
Total cost of growing and harvesting...	3	6	8
Rent, one year	0	10	0
Cartage to rail, 5 miles distant, at 5s. per ton	0	2	10
General depreciation, and interest charges on horses and plant	0	4	10
Total cost of 20-bushel crop...	£4	4	4

The above is based on an 8-hour day. For the crop that follows maize one ploughing is sufficient; but for the long-season crop following the fodder crop two ploughings are usual, and the additional ploughing would cost an extra 6s. 6d., being more easily and quickly accomplished than the first ploughing.

For hay, we like to cut the wheat in the flowering or early grain stage. No grain, or only shrivelled grain, is preferred to fully matured grain in a sample of hay chaff. As the object is to get stock to eat the whole plant, it is well to cut the crop when the nutriment is best distributed throughout the plant and when palatability is also greatest, and these things are both secured by cutting at the stage indicated.

In harvesting hay for chaffing purposes in the New England district special care is necessary in stooking the sheaves. The method adopted on the farm is to set up four sheaves in each stook (two and two in a diamond) and then tie them together with a band of hay. A good spread is given to

the sheaves at the bottom to enable them to dry quickly and to prevent them from being blown over. The cost of stooking for hay and chaff is a little greater than for grain.

Throughout the district, the stacks built are all round ones, and if well made they require no thatching, aud will throw any water off.

ESTIMATED cost of producing an acre of wheat for chaff in New England—Estimated yield, 2 tons.

	£	s.	d.
Ploughing, once (land previously under cultivation) ...	0	7	6
Harrowing, twice, at 1s. 4d. per acre ...	0	2	8
Drilling... ...	0	2	0
Seed, 90 lb. at 7s. 6d. per bushel ...	0	11	3
Superphosphate, ½ cwt. at 7s. per cwt. ...	0	3	6
Pickling seed at 4d. per bushel, 1½ bushels per acre ...	0	0	6
Cutting with binder ...	0	3	2
Twine, 5 lb. per acre at 8½d. lb. ...	0	3	6
Stooking for hay ...	0	5	8
Carting and stacking ...	0	11	8
Cutting for chaff, 2 tons at 12s. per ton ...	1	4	0
Bags, 2 doz. per ton, at 8s. per doz. ...	1	12	0
Total cost of growing, harvesting, and chaffing ...	5	7	5
Rent, one year ...	0	10	0
Cartage to rail, 5 miles distant, at 5s. per ton ...	0	10	0
General depreciation, and interest charges on horses and plant ...	0	4	10
Total cost of 2-ton crop ...	£6	12	3

THE BREAKING STRAIN OF TIMBERS.

THE following table compares the breaking strain of Australian hardwoods with American white pine:—

	Weight per cubic feet.	Breaking stress in lb. per square inch.
Pine ...	54·31	15·901
Red Ironbark ...	76·52	19·609
Grey Box ...	73·62	22·415
Cypress Pine ...	50·00	4·359

—A. BROOKS, Works Overseer.

SALE OF MERINO FLOCK RAMS.

AN auction sale of Merino flock rams will take place at Nyngan Experiment Farm on Wednesday, 20th July, when 110 rams will be offered in pens of five, together with a few of the better class selected rams, which will be offered in single lots. The animals will be available for inspection on the morning of the day of the sale.

Further particulars are obtainable on application to the Manager, Experiment Farm, Nyngan; the Under Secretary and Director, Department of Agriculture, Sydney; or Messrs. Smith and Holmes, Auctioneers, Nyngan.

On 20th July the Sheep and Wool Expert will give a demonstration of wool-rolling, piece-picking, skirting, and wool-classing.

Hay that Caused Skin Irritation.

During the months of April and May men who were handling and chaffing wheat at Grafton Experiment Farm suffered severely from irritation and skin rashes, which spread over the body, forming white blisters. In a measure the trouble was controlled by the men wearing dungaree coats and wrapping handkerchiefs around their necks and tying the sleeves on their arms. Various ointments were tried, but none appeared to prevent the irritation and the skin eruption.

Sheaves of the wheat were sent to Sydney by the Manager, Mr. G. Marks, and were examined by Mr. W. W. Froggatt, Government Entomologist, who found very dark coloured grain weevils and a small moth present, but none that would have the irritating effect described. It was considered, however, that the irritation was probably caused by a small harvest mite that at times is very common in hay. This tiny creature punctures the skin and sets up intense irritation. None of these were found in the sheaves, but they might easily have dropped out during the knocking about on the journey.

With regard to preventive measures, Mr. A. H. E. McDonald, Chief Inspector of Agriculture, suggested that perhaps the trouble could be reduced by steaming the hay. Steaming is commonly done in western districts to reduce the brittleness of the straw and improve the quality of the chaff. The steam might not kill the mites, but it would perhaps prevent them from biting. In the absence of the tunnel used in the west for the steaming process, the sheaves might be thrown into small heaps and the steam turned on, or it might even be injected into the surface of the stack.

The Fashioning of Horns of Stud Cattle.

The Department was asked lately about the practice of training the horns of stud or show cattle. The reply was that in some cases it becomes a vice, and the purchaser is often led to believe that he is buying a typical animal, with the result that his herd may be spoiled so far as the type of the head is concerned.

The Stud Book allows a fairly wide range in regard to the horns, and if breeders cannot produce the type by breeding and selection, amendments should be made to the scale of points. It is wrong, and it seriously affects a breed to judge it by any feature that has to be artificially produced and that cannot be handed down to the offspring. The neat periwinkle-shaped horn produced in some breeds by the aid of the file, saw, heat, tension, weights and dubbing, was originally a straight steer-like appendage. Excessive training of horns should be a disqualification.

Where stud animals are purchased with typical horns not artificially produced, no trouble should be experienced in this respect if the following precautions are adopted :— (1) Correct feeding of the young stock ; both over and under feeding produce variations in the horns. (2) Protection from injury while feeding, &c. (3) Where through injury a slight deviation from the normal occurs, a little pressure or weight or some other simple method will correct it.—J. A. Robertson, Herdmaster.

Producing Lucerne Hay under Irrigation Conditions.

Methods and Experiences at Yanco Experiment Farm.

[Continued from page 390.]

F. G. CHOMLEY, Manager, and F. CHAFFEY, Farm Foreman.

Making the Check Banks.

The method of irrigation adopted is flooding, but flooding over limited areas, and between check banks that run down the field in the direction of the fall. The formation of these check banks is the next operation. They are placed half a chain apart and are formed by throwing two furrows together with a single-furrow plough. The soil is then filled into the furrow with a road grader to which is attached a long blade made on the farm, so that the soil is levelled and the banks strengthened. The preservation of these banks throughout the life of the lucerne stand is essential, for they are a most important feature in thorough and efficient application of the water Hence, on account of these banks, as well as the preservation of a level surface between them, all subsequent work must be in the same direction—that is, from head ditch to drain. The ends of the checks have to be finished off by hand, as the road-making or levelling machine referred to will not work right to the end of the paddock.

It is most essential that the blocks should not be too long; in other words, the distance between the head ditch and the drain at the lower end should not be more than 6 or 7 chains. At that length the levels can be easily obtained. and an even flow of water from the upper end to the lower assured, but longer blocks are irrigated with difficulty. On a block made 15 chains long some years ago, it was found that the upper end of the lucerne had got too much water before the lower end had got any at all.

The drain along the lower end of the paddock is quite essential, as every irrigationist well knows. Stagnant water is a thing not to be tolerated on a well-managed irrigation farm; hence, drainage must be provided as a concomitant of the head ditch, or damage will certainly occur.

Working the Seed-bed.

In April the land thus prepared for sowing is treated to an application of water. No doubt some will wonder, but so it is. It is found that if the soil (already warm and well worked) is also moist, the seed germinates quickly and also evenly. Sowing in a dry seed-bed has been one of the common causes of failure on the irrigation areas. In such cases the seed is sown with the intention that the ground shall be irrigated after sowing (perhaps, too, with the hope that rain will make irrigation unnecessary), but the

method is rarely satisfactory. In many cases the effect of the irrigation water is to cake the surface over the tender little seedlings, which are therefore unable to reach the sun and air. Does it need to be pointed out that to attempt to disturb the surface at that stage is almost as fatal to the little plants as to leave it alone? The lucerne seedling is a very tender thing indeed, and disturbance in its early life is one thing it takes as most unkind. All cultivation of lucerne must be after the plant is well rooted—and to sow the seed in a dry seed-bed is simply sowing a crop of troubles. One grower who tried this method had a novel experience; the water floated the seed off the higher portion of the ground and deposited it on the lower, giving him half his area much too thick and the rest much too thin.

How we obtained a moist seed-bed, let us explain. In April the land is furrowed out between the check banks with special furrowing shovels attached to an ordinary cultivator. These shovel points, which really belong to the Planet Jr. type of fittings, make the furrows 2 feet apart, which means three or four of the points on the cultivator. The water is then turned into these furrows from the head ditch, and the land thoroughly saturated; the water is confined to the furrows as much as possible, and it advances slowly along the furrows, soaking downwards and laterally, and giving a far better result than would be obtained by flooding between the check banks without furrows. It takes the water three or four days to reach the lower end, but the furrows are not allowed to overflow.

Forming the Check Banks—the first furrow.

Should the land have been fouled with weeds, it would be well, perhaps, to forego (in part) the advantages of the fallow period, and to form the check banks and furrows earlier in the year, turn in the water to germinate the weed seeds, and kill them by cultivation. A further irrigation in view of the sowing of the lucerne will probably then be necessary, according to the state of the ground when the beginning of April arrives.

The Sowing.

The land being thus well irrigated, as soon as the surface is dry enough to carry the teams, the tine cultivator is employed to produce a level and fine surface. The seed-bed is now in an ideal condition, and the seed is sown at once, the drill being generally no more than half a day behind the cultivator. If by any mischance the ground unfortunately dries out before the seed can be sown, it is better to cultivate and irrigate again before sowing

rather than to attempt to do any good on the dried out surface. If, for any other reason, the seed fails to germinate after treatment on these lines, it is better to leave the whole thing until next year, and to use the paddock in some other way in the meantime.

The seed used on the farm is obtained from Tamworth, that being the only seed now sown for farm crops. Many varieties and sub-varieties have been sown, but Tamworth Broadleaf lucerne has given far better results than any other.

For the sowing, the grass-seed attachment of the ordinary wheat drill is used, the seed being fed at the rate of 10 lb. of seed per acre through all the tubes into the main hoes of the drill. Some farmers use the drill but sow

The Road Grader, showing the wide board, 19 feet long, which replaces the steel board for check-bank making.

broadcast, leaving the tubes out of the hoes; the results are seldom so satisfactory as when the seed is put down into the soil with the aid of the hoes (withal, of course, not too deeply). Let it be remembered in what a prime condition the soil now is, and all that is required to ensure good germination is to place the seed down on the moist soil. The soil warmth and the moisture will do the rest.

To ensure a sowing 1½ inches to 2 inches below the surface, the drill is set in the first notch; the soils on this farm, as already stated, are stiff, and this is necessary under such conditions. Where the soil is a fine loam, the hoes could run free, and not in the notch at all, and the weight of the hoe would be sufficient to sow the seed deep enough. When sowing the headlands where the horses have trampled down the surface, our practice is to put the drill in the second notch in order that the seed may be sown at the right depth. The principal thing is to ensure that the seed is put down on the moisture and to work the drill to that end.

Superphosphate is sown through the manure box of the drill at the same time as the seed, 56 lb. per acre being applied. The manure is also sent down the hoes of the drill, so that it may be deposited close to the seed where

The Road Grader at work. A light cut only is taken and two trips made on each side of the bank so as to move just sufficient top-soil to fill in the furrow and strengthen the check bank.

Furrowing out with special shovels on the cultivator for irrigating.

it can be made use of at once. Superphosphate has a distinct value in relation to lucerne, having given better results under our conditions than any other fertiliser. The top-dressing of lucerne stands in the winter or spring

has given marked results and should become part of the farm practice of growers in almost every part of the State, but in connection with the establishment of a stand it also has a definite utility.

Irrigation by furrows previous to cultivating and sowing.

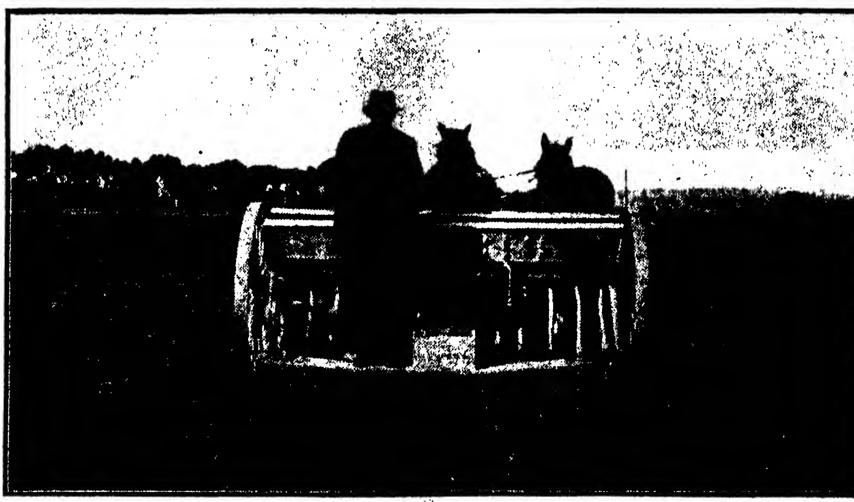
Cultivating the surface after irrigating and before sowing.

We now have our lucerne seed in the ground, and under conditions that could hardly be improved upon. The last farm operations—the furrowing, irrigating, and sowing—have been accomplished within a few days; the soil

is still warm and it is thoroughly moist. Amid such favourable surroundings the lucerne seed—hard though it is, and lucerne seed has a very hard exterior that requires a good deal of moisture to soften it—usually germinates within four days and the rows can be clearly seen in ten days.

Handling the Young Stand.

The seedling lucerne plants are thus up by the early part of May and winter showers keep it growing slowly until the spring. As already stated, young lucerne does not care for cultivation, and nothing of the kind is attempted here, with the possible exception (under very adverse circumstances) of running a light seeding harrow over the crop with the tines sloping backwards. The plant is delicate and will not stand being disturbed at this stage, though it will resist drought surprisingly. Indeed, more young lucerne plants are killed by too much water than by too much dry weather, for lucerne is distinctly hardy in respect to the latter.



Drilling-in lucerne seed : this operation follows immediately after cultivating.

In the spring—about September—it is advisable to run the mower over the ground and to allow the very light cutting to remain on the ground; the same may have to be done again in October, though it may be possible with a good stand to let the second growth go for a light hay crop. The plants must be encouraged to stool at this stage, however, and cutting is valuable to that end. The growth must be watched at this stage with care, for (as with most other plants) as soon as the conditions become a bit adverse there is an impulse to preserve the species by setting seed—an occurrence that cannot but exhaust the plant and permanently affect its vigour.

Perhaps in November a cut worth saving as hay will be obtained, and by that time an application of water will most probably be necessary. It is one of the disadvantages of spring sowing that before the plant has attained

any height it may be necessary to apply water, which in turn makes a light harrowing a necessity in order to loosen the surface and let the little plants grow. Such a disturbance is never in favour of the plant, but in such circumstances it may be unavoidable. Sometimes, if the surface has become set, it is possible to give a very light watering and then to run an ordinary tine harrow over the ground.

(To be continued.)

FIELD NOTES ON *Goniozus antipodium.*

THIS little hymenopterous parasite is a well-known enemy of the codlin moth. but I have lately found it also attacking the grub of the peach-tip moth. It was described by Mr. W. W. Froggatt, Government Entomologist, in his paper "Codlin Moth Parasites" in the pages of this journal in 1906, and he has identified specimens I lately bred out at Epping.

I had noticed that the peach-tip moth had been infesting quinces in the latter part of the season 1920-21, and I placed bandages on four quince trees. On 18th March, as I was removing one of these bandages, I found one peach-tip grub with seven small yellow wasp larvæ hanging to its sides, sucking all the juices out of it. On another I found four, and on several others from two to four. Two specimens of the adult wasp were also found right inside the cocoons of the grubs, and on one grub there were three freshly laid eggs. These were put away for development, and on 12th April, eight fine healthy adult specimens could be seen flying around the jar. A supply of fresh grubs was put in, and on the following day I watched a female wasp deposit an egg on a grub on which she had previously laid four. Later on, on 19th April, nine young larvæ could be counted on one grub, four on another, and three on another, and a number of freshly laid eggs. Altogether they appeared to be quite happy in their captive state. They moved about quickly, and did not appear at all shy. On 15th June nine of the wasps bred in captivity were still alive and healthy, though there were no signs of eggs; one was then inside a grub cocoon.

Goniozus antipodium is a small black ant-like wasp, about one-eighth of an inch in length, with the abdomen thick at the base and tapering off to a sharp point. The eggs are oblong, clear and glassy, but so small that they can scarcely be detected with the naked eye. The larvæ are small yellow, pear-shaped creatures. The cocoons of the pupæ are of white silk, rather loosely spun, and are attached to the bandage or bark of the tree close to the empty skin of the host. They are not internal parasites. The eggs are laid on the outside of the host, the tiny larvæ thrust their suckers into the sides of the grub, and there hang until they have sucked all the juices. Then they spin their cocoons close by, and await their development.

From two bandages taken from quince trees in another orchard on 11th March, containing about sixty-four peach-tip grubs, I bred nineteen striped wasps, *Gambus stokesi* (internal parasites), sixteen black wasps, *Goniozus antipodium* (external parasites), one black wasp (*Proctrotrypid* sp.), and six peach-tip moths. Two peach-tip moth grubs had dried up, and eighteen remained in the larval state. From bandages containing codlin grubs only I did not get any of these wasps, but I noticed that they laid a number of eggs on a codlin grub that was put in the jar.—L. GALLARD, Fruit Inspector.

Fumigating Maize with Carbon Dioxide.

Shelled maize may be protected from weevil with carbon bisulphide (as described in the *Agricultural Gazette*, October, 1920), or with carbon dioxide gas. If the latter is preferred, the maize should be placed in an ordinary galvanised-iron tank, and the gas passed slowly in by means of a rubber tube connected with the tap hole of an ordinary cylinder of carbon dioxide gas, such as is easily procurable from various firms. The cylinder should be placed on an ordinary weighing machine, and the weight noted, and then 1 lb. of gas allowed to flow into the tank for every 12 bushels of grain. The contents of the tank can be estimated at 12 bushels of grain to 100 gallons capacity, so that a 500-gallon tank will hold twenty bags (60 bushels) of shelled maize, and therefore (whether full or not) should have 5 lb. of gas. The lid of the tank can be left off, as the carbon dioxide gas is heavier than air, and if it is admitted slowly (at the rate of 1 lb. in three minutes) it will push the air up and out of the manhole as it sinks to the bottom. A lighted candle held in the tank above the grain should go out for lack of oxygen. When sufficient gas has been admitted the tube should be withdrawn, and the lid put in place on the tank, with a rubber ring or a sack under it to prevent the gas from escaping. Any weevils or grubs present will die within about seven days.

The maize may be kept in these fumes for over a year without being affected for either seed or food and without developing weevils. At Grafton Experiment Farm maize has been so stored for eighteen months. The gas is quite harmless and non-explosive, and costs 6d. per lb.

The carbon bisulphide is probably less trouble, and though inflammable and explosive, can be handled with safety provided care is used and no light or fire or lighted cigarette or pipe is allowed near it. The maize must be fairly dry before being placed in a sealed tank, or it will deteriorate.—W. W. Froggatt, Government Entomologist.

Cattle Improvement in Denmark.

In Denmark the trend of cattle breeding is mainly to increase the number of dairy cows and improve their quality. This is evident from the fact that the number of milch cows was almost doubled in the last half century, and that in 1914 they constituted about 54 per cent. of the total cattle population of the country. The average milk yield, which in 1861 was only 220 gallons per cow, was increased until in 1914—the latest normal year—it had reached 605 gallons per cow. During the same period the butter-fat yield was increased from about 70 lb. to 240 lb. per cow. . . . . What is responsible for the production of the high grade milk-producing machines which the cows . . . . have now become?

Better feeding and more comfortable housing have contributed, but the main cause has been the ruthless elimination of all "bad animals," both male and female. In Denmark a "good" cow means not only a sound healthy animal, but an animal giving a high yield of butter-fat; and similarly a "good" bull must not only be the son of a "good" cow, but must be capable of transmitting to his progeny the qualities of his line.—*Journal* of the Department of Agriculture for Ireland.

Farmers' Experiment Plots.

POTATO TRIALS, 1920–21.

Lower North Coast.

J. M. PITT, Assistant Inspector of Agriculture.

POTATO trials were conducted by the Department in co-operation with the following farmers during the season 1920–21:—

J. G. Ward, Sherwood, Macleay River.
F. Kemp, West Kempsey, Macleay River
J. W. Smith, "Hazeldean," Wauchope, Hastings River.
A. Longworth, Ghinni-Ghinni, Lower Manning River.
J. P. Mooney, Dumaresque Island, Taree.
R. Dyball, junior, Taree Estate, Manning River.
Singleton and Poole, Mondrook, Manning River.
Thos. Hoad, Mount George, Upper Manning River.
J. C. Duft, Mount George, Upper Manning River.
Alex. Smith and Atkins Bros., Bandon Grove, Williams River.
M. Smith, "Bona Vista," Paterson River.
W. Read, Wallalong, Hunter River.
J. G. Perrett, Miller's Forest, Hunter River.

In the Macleay and Hastings districts August was rather dry, but ample rain fell during the remaining months of the growing period. At Sherwood a hailstorm of more than ordinary severity for October severely damaged the crop, a great many of the stalks being either severed or broken.

Along the Manning the early growing months were also on the dry side, but rain fell in sufficient quantities from November onwards. Westerly winds were prevalent during August and September. The plot at Taree Estate, sown during a high wind, suffered in consequence, germination being affected by the dry seed-bed; and, as dry weather followed, many sets rotted.

Further south, in the districts along the Hunter and its tributaries, the season began wet but became drier towards flowering time, resulting in moderate to poor yields.

RAINFALL, where available, in points

Months.	Macleay.		Manning District.			Hunter and Tributaries.			
	Sherwood	Kempsey.	Taree for Dumaresque Island	Taree Estate, Mondrook.	Mt. George.	Wallalong.	Bandon Grove.	Paterson.	Miller's Forest.
	pts.	pts.	pts.	pts.	pts.	pts.	pts.	pts.	pts.
August ...	18	41	16	10	65	96	...	...	107
September ...	256	292	127	122	148	149	381	137	238
October ...	365	282	161	75	156	54	97	52	50
November ...	213	419	315	225	236	258	85	267	247
December ...	217	273	452	433	489	...	825	1,511	...

The advice given in previous years as to the preparation of a good moist seed-bed cannot be repeated too often. To ensure a reserve of moisture and plant food in the soil one cannot start the preparation of the plot too early. Many farmers speak adversely of the advantages of even a short fallowing, regarding it as a waste of time and land. For maximum yields—and a farmer should aim at nothing less nowadays, since the prices of seed, labour, &c., have advanced to such an extent—half measures should be eliminated.

Cropping with the same class of crop is too much in evidence. Maize, cowpeas, field peas, pumpkins, &c., are all good crops to use in rotation. Overdoing the use of the plough is quite unnecessary, even on the dirtiest of lands. In one instance the land was ploughed four times after the harvesting of the autumn crop.

On the average alluvial soil that is not liable to run together, a deep ploughing in the autumn that will turn under stalks, rubbish, &c., followed by a discing or two before sowing time (or a shallow ploughing should a disc be unavailable), and a harrowing or two, usually suffices to ensure a good seed-bed and a reserve of moisture, plant food, &c. The plough often brings fresh supplies of weed seeds to the surface to germinate, whereas the disc works only in the surface few inches.

Cultural Notes.

Sherwood.—Medium loam; fallowed 1918–19; cowpeas in 1919 (fed off). Ploughed deeply in early autumn and again in May; disced before sowing; seed-bed excellent; sets ploughed in on 19th August. Plot badly affected by hailstorm; ladybirds fairly numerous.

West Kempsey.—Stiff loamy soils, new land, four years under pasture. Lightly ploughed in June; harrowed twice and rolled; deeply disc-ploughed in July; harrowed three times and rolled; disc-ploughed in August, and broken into good tilth with harrow and roller; drilled in on 13th to 18th August. Plot neglected during first few weeks after germination; hard surface, conducive to attacks of blight under the weather conditions prevailing; few ladybirds present.

Wauchope.—Rich loamy soil; newly broken. Ploughed shallow; disced three times; harrowed; twice disc-harrowed again, and twice harrowed; seed-bed somewhat grassy. Sets sown on 10th August in drills; a few ladybirds present.

Ghinni-Ghinni.—Loamy soil. Disc ploughed; rolled; harrowed; cross-disced; harrowed twice; again ploughed and harrowed; seed-bed good, but rather dry. Sown on 2nd September. Dry months following planting caused spindly growths in the open soil.

Dumaresque Island.—Extremely rich loamy soil; previous crop maize. Ploughed and worked three times; seed-bed in splendid tilth; rows 2 feet 6 inches apart; sets 10 inches apart (in drills). Sown on 6th August.

Taree Estate.—Stiff loam; previous crop potatoes. Disc-ploughed in April; fallowed till July; again disc-ploughed, rolled, and harrowed; ploughed, harrowed, and rolled again early in August. Seed sown on 10th August under adverse conditions; seed-bed dry. Owing to cold weather and fear of blight, irrigation was delayed until October. Germination poor; plants spindly.

Mondrook.—Sandy loam; previous crop maize (1918–1919). Ploughed early; harrowed three times; good seed-bed. Sets sown on 24th August; good growth throughout.

Mount George (Mr. Hoad's).—Loamy soil; previous crops, potatoes in 1918; maize in 1918–19; pumpkins in 1919–20. Disc-ploughed in May 15 inches deep; rolled; disc-harrowed and drag-harrowed previous to sowing; seed-bed rather dry owing to wind during the day of planting. Sown on 11th August.

Mount George (Mr. Duff's).—Heavy loam; previous crops, maize in 1918 pumpkins in 1919–20. Disc-ploughed in April; harrowed, disced and harrowed in July; seed-bed in good order. Sown on 12th August. The early months were rather too dry for maximum yields on the two plots at Mount George.

Bandon Grove.—Loamy soil; previous crops, lucerne in 1918; maize in 1919–20. Ploughed [in] March; harrowed; ploughed again May and early August; harrowed and rolled. Sets ploughed in on 23rd August.

Paterson.—Light sandy loam; previous crops, lucerne; maize in 1919. Ploughed in March; again during July, and immediately prior to sowing, followed each time by harrow. Sets ploughed in on 16th August, then rolled; ladybirds present.

Wallalong.—Old lucerne bed; alluvial. Ploughed early in autumn, left in fallow; ploughed twice in July, and harrowed three times; soil well broken down. Good seed-bed, though rather open. Seed sown on 17th August. Germination good. Green potato grub completely ate out the Satisfactions. Ladybirds in great numbers on the remainder.

Miller's Forest.—Stiff loamy soil; previous crops, lucerne in 1917; maize in 1918; millet in 1919. Ploughed in February; harrowed and scarified in July. Sets ploughed in on 13th August. Grubs and ladybirds present in great numbers. Dry weather at flowering stage had a very harmful effect both on this and on the Wallalong plot. Brownell's Beauty produced runners and no tubers.

Time of Sowing.

Early sowings gave the most satisfactory yields throughout, and planting as early as the middle of July can safely be recommended, especially in a season such as the present, where the months leading up to the spring are wet. Frosts are not to be feared where the soil is well charged with moisture and the cultivator is used to keep the surface soil well worked. It is the practice in some potato-growing regions in America, where frosts are severe, to throw a little soil with the cultivator over the newly germinated plants. While that is hardly necessary on the central coast, the use of the

cultivator often between the rows is strongly recommended. Early-sown crops avoid the dry spells during November at the critical stage of their growth; furthermore, the market is more assured for the early tubers. During the present season, crops marketed during November and early December realised from £14 to £11 per ton, while those marketed after the new year were difficult to dispose of at any price. Many farmers, notably those on the Macleay, let hundreds of bags rot rather than sell at a loss. One farmer marketed 200 bags and received the handsome cheque of £1 5s., with which to cover seed and all sowing and harvesting operations.

Numerous prizes were taken by farmers exhibiting specimens from the plots in local shows.

Varieties and Fertilisers.

Factor, Up-to-date, and Brownell's Beauty were the best varieties, and many exceptionally large tubers of Manhattan were dug. Dalhousies and Early Manistees were fair, Early Rose poor, and Carman the same, owing to the inferior seed. Early Rose and Carman were blighted along the Macleay.

In the fertiliser trials, the best results were obtained from P7 (equal parts of bonedust and superphosphate) and P5 (superphosphate four parts and muriate or sulphate of potash one part). Heavy dressings of both (up to 6 cwt. per acre) were profitable, giving greatly increased yields in comparison with smaller quantities. The composition of P8 is equal parts of blood and bone and of superphosphate.

Results of Variety Trials.

—	Wauchope.	J. C. Duff. Mt. George.	Wallalong.	Miller's Forest.	Ghinni-Ghinni.	Taree Estate Irrigated.	Taree Estate Non-Irrigated.
Fertiliser.	2 cwt. P7.	2 cwt. P7.	2 cwt. P7.	2 cwt. P7.	2 cwt. P7.	2 cwt. P7.	2 cwt. P7.
	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.
Factor	13 0 1 6	9 1 2 0	3 8 3 0	......	5 16 3 14	3 11 2 22	2 16 3 24
Early Manistee	13 0 2 3	6 5 0 12	......	1 7 3 0	......	1 19 1 4	1 17 1 8
Carman	......	5 11 0 6	......	1 7 3 14	......	3 10 2 24	2 15 3 26
Manhattan	......	6 8 1 10	......	2 19 3 20	4 10 1 12	......	......
Brownell's Beauty	......	......	2 9 0 1	......	5 4 1 12	3 15 2 24	3 9 2 26
Dalhousie	12 0 3 0	Very Poor.	2 4 0 7	......	......	2 9 0 12	2 11 0 8
Satisfaction	......	......	......	2 3 0 24	......	3 2 3 12	2 19 3 24
Up-to-Date	14 0 2 7	8 7 1 13	2 7 0 6	1 15 3 11	7 3 1 20	2 6 0 18	2 2 0 26
Early Rose	7 0 2 7	Failure.	2 1 1 0	......	......	......	......

—	Paterson River.		Williams River.		West Kempsey.	Mondrook.	Sherwood.
Fertiliser.	2 cwt. P7.	2 cwt. P5.	2 cwt. P7.	2 cwt. P5	No Fertiliser.	No Fertiliser.	No Fertiliser.
	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.
Factor	......	......	......	......	......	7 4 0 26	8 8 3 20
Early Manistee	0 16 2 22	0 13 3 0	......	......	......	......	......
Carman	......	......	2 12 10 1	3 10 0 16	3 8 3 0	4 10 1 12	3 19 1 22
Manhattan	1 13 1 6	1 5 2 4	......	......	7 11 1 0	5 12 3 6	3 15 2 12
Brownell's Beauty	......	......	......	......	9 0 2 24	......	......
Dalhousie	......	......	......	......	......	6 4 2 10	5 19 2 6
Satisfaction	1 3 2 8	0 10 2 16	2 1 2 3	1 15 0 8	......	......	5 8 3 20
Up-to-Date	0 19 2 16	0 19 2 16	4 16 3 7	4 11 3 1	7 5 1 2	9 6 1 8	4 16 1 0
Early Rose	1 4 2 6	1 4 2 6	......	......	Failure.	......	......

Results of Fertiliser Trials.

	Wauchope.	J. C. Duff. Mount George.	Sherwood.	Mondrook.	Taree Estate. Irrigated.	Taree Estate. Non-irrigated.	Dumaresque Island.	Wallalong.	West Kempsey.
Variety used–	Up-to-Date.	Up-to-Date.	Up-to-Date.	Up-to-Date.	Up-to-Date.		Brownell's.	Early Rose.	Carman.
	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb	t. c. q. lb.	t. c. q. lb.
No Manure	11 6 1 21	8 12 3 12	4 16 1 0	9 6 1 8	2 11 0 8	1 19 1 4	9 7 1 16	....	3 8 3 0
2 cwt. P7	14 0 2 7	9 1 1 4	4 16 1 0	11 2 2 20	2 6 0 18	2 2 0 26	8 19 0 16	2 1 1 0	4 2 2 0
3 ,, P7	....	....	4 17 1 20	....	2 19 3 24	2 1 1 0	10 14 2 0	2 9 0 12	....
4 ,, P7	....	9 12 1 2	....	11 19 0 18	....	....	....	....	4 5 1 2
5 ,, P7	....	....	5 6 0 8	....	....	....	....	....	....
6 ,, P7	....	....	....	12 6 0 8	....	....	....	....	5 4 0 12
2 ,, P5	....	....	5 10 0 0	9 6 0 27	....	....	....	2 1 0 8	....
3 ,, P5	11 6 1 21	8 12 3 12	5 5 1 4	10 2 2 18	3 12 2 20	2 19 3 24	11 3 3 20	3 9 2 16	....
2 ,, P8	....	....	....	....	....	....	....	....	....
3 ,, P8	11 0 0 0	8 5 0 0	....	....	3 3 3 10	2 9 0 12	9 13 1 4	....	4 19 0 22
4 ,, P8	....	8 1 1 9	....	....	....	....	....	....	....
2 ,, Superphosphate	....	8 7 1 13	....	....	....	....	....	....	....
3 ,, Superphosphate	....	....	....	....	....	....	9 10 3 20	....	....
4 ,, Superphosphate	....	9 1 2 0	....	....	....	....	....	....	....

At Miller's Forest the fertiliser trial failed, owing to Brownell's Beauty not setting tubers.

A fertiliser trial which included nitrate of soda, was conducted at Mr. T. Hoad's farm, Mount George, the results being as follows:—

Fertiliser	Yield. t.	c.	q.	lb.	Fertiliser.	Yield. t.	c.	q.	lb.
No manure	10	7	2	3	3 cwt. Superphosphate and 1 cwt. nitrate of soda ...	11	11	3	4
3 cwt. Superphosphate ...	11	9	3	8	4 cwt. Superphosphate ...	11	6	3	14
3 cwt. Superphosphate and ½ cwt. nitrate of soda ...	11	9	3	8	4 cwt Superphosphate and 1 cwt. nitrate of soda ...	11	10	3	6

The nitrate of soda was sprinkled along the rows about six weeks after germination.

All the fertilised plots outyielded the unfertilised plots, and very little increase—if the 1 cwt. application with 4 cwt. superphosphate be excepted—was gained by the top-dressing with nitrate.

An experiment was conducted on the same farm in distances of sowing, with results as follows:—

Section I. Rows Apart.	Distance Apart in Rows.	Yield. t.	c.	q.	lb.	Section II. Rows Apart.	Distance Apart in Rows.	Yield. t.	c.	q.	lb.
(*a*) 27 inches	22 inches.	11	2	3	22	(*e*) 36 inches	22 inches.	8	0	0	10
(*b* 27 ,,	18 ,,	7	18	0	14	(*f*) 36 ,,	18 ,,	8	10	3	16
(*c*) 27 ,,	14 ,,	8	6	3	24	(*g*) 36 ,,	14 ,,	9	18	1	26
(*d*) 27 ,,	10 ,,	8	9	3	22	(*h*) 36 ,,	10 ,,	8	19	2	16

In analysing the above, it will be noticed that in Section I (*a*) planting the sets about 2 feet apart, both ways, gave the highest yield, while the close planted plot (*d*) yielded considerably less. Planting in drills too close has as its chief drawback the difficulty in scuffling without damaging the tubers, &c.

In Section II a very satisfactory yield resulted from (*g*), the method usually adopted in all the experiment plots, and also from (*h*). Sowing at the maximum distance both ways (*e*) resulted in a low yield.

An experiment to demonstrate the value of "greening" the tubers was also conducted on the same farm. A quantity of seed was kept spread out in a shed; at the same time similar seed was placed in shallow trays, in single rows, rose ends upwards, and kept in the open, and covered at night when frosts were likely. Three weeks later the two lots were sown side by side. The "inside seed" had developed good shoots, white in colour, whereas the "outside seed" had gone greenish in colour, and had developed strong, firm, short green shoots, making an attractive sample of seed. Although the period allowed for "greening" was rather short, the weights were in favour of the latter method. Earlier maturity is another favourable feature of this procedure, but probably owing to the short period allowed very little difference was noticed in this respect.

The following are the yields from the two lots, the seed being sown in rows 3 feet apart, and 14 inches apart in the drills:—

Sets.	Yield. t.	c.	q.	lb.	Sets.	Yield. t.	c.	q.	lb.
2¼ oz., halved, kept in shed	13	1	1	0	2½ oz., halved, greened in open ...	13	10	0	10

Another experiment testing the size of seed was also made:—

	t.	c.	q.	lb.
1½ oz. tubers (whole)	12	10	2	16
1½ oz. half-sets	12	0	1	20
3 oz. sets (whole)	13	15	2	7

Whole tubers yielded better than half-sets of similar weight. Large whole tubers yielded 1¼ tons more than the small whole tubers.

A Boom in Tested Cows.

Many advantages have been claimed for the keeping of milk records of dairy cattle, but it needed a series of very successful sales in England in 1920 to demonstrate the financial possibilities of this side of herd-testing—as we are wont to call it in New South Wales. The Irish Department of Agriculture's *Journal* remarks that " it is quite conceivable that these sales mark the beginning of a new era in which the authenticated milk record will be the determining factor in deciding the value of a dairy cow." Then follows the particulars of several sales of cattle held in England in the latter part of 1920, the average price and the number of cows sold at each being shown. Somewhat at random we may take the following:—On 2nd September, at Reading, seventy-seven cows averaging £106 16s. 5d.; on 14th September, at Oxford, thirty-nine cows averaging £112 6s.; on 23rd September, at Oxford, sixty-two cows and heifers averaging £110 13s.; on 5th October, at Cambridge, ninety-one cows averaging £74 14s. 8d.; on 12th October, at Yeovil, thirty-three cows averaging £128 7s. 6d., and so on; sixteen sales are thus particularised, and the lowest average was £74, over a sale of 80 heifers.

The animals were sold as non-pedigree cattle, and were mainly of the dual purpose Shorthorn type. The record price was 270 guineas, paid at Oxford on 23rd September, for a non-pedigree four-year-old cow of Shorthorn type, and several cows at the sales realised over 200 guineas. In many cases the sales were dispersal sales, entire herds coming under the hammer.

A few years back, adds the *Journal*, such averages would have been considered highly satisfactory for herds with long pedigrees and fashionable breeding.

An attempt was made in one case to determine the increase in price attributable to herd-testing. The herd consisted of thirty-two cows and sixty-seven heifers. Less than a month before the sale a local valuer valued the lot at £3,812. At the sale the herd realised £6,800, or practically 80 per cent. more.

The logic of such facts is surely irresistible.

Farmers' Bulletin, No. 138, which details the results of the nineteenth year's egg-laying tests at Hawkesbury Agricultural College is now available, and copies are obtainable on application to the Under Secretary and Director, Department of Agriculture, Sydney.

Field Experiments with Wheat.

Cowra Experiment Farm.

C. McCAULEY, Assistant Experimentalist.

[The Experiments Supervision Committee, under whose control these experiments are conducted, direct attention to the fact that definite conclusions cannot be drawn from the experiments of any one year, but the results are published for the information of farmers.]

An experiment, the object of which was to determine the most suitable varieties of wheat for hay and grain locally, was conducted at this farm. It was divided into four sections, namely, early planting for hay and for grain, and late planting for hay and for grain.

The early planting sections were sown at the rate of 42 lb. per acre on 15th April, 1920, superphosphate being applied at the rate of 60 lb. per acre. Germination took place on 22nd April, the seed-bed being in excellent order and free from weeds. Owing to the dry weather prevailing during May the early growth was very slow, but good rains fell during June, and the subsequent growth was very rapid. Warden and Hard Federation made the best early growth. All plots had evened up by the end of July, though Warden had made far more vigorous growth than the other varieties.

The late planting sections were sown at the rate of 52 lb. per acre on 12th May, 1920, superphosphate being applied at the rate of 60 lb. per acre. Germination took place on 24th May, and owing to the favourable season all plots made rapid growth. Gresley, Firbank, and Clarendon made the best growth throughout the season.

The plots were so tangled about by heavy storms during October and December that it was impossible to harvest individual plots in the grain section.

The plots measured ⅛ acre. The hay yields per acre, based on percentage, were as follows:—

Early Planting Section (Hay).					Late Planting Section (Hay).				
Variety in order of Merit.	Yield.				Variety in order of Merit.	Yield.			
	t.	c.	q.	lb.		t.	c.	q.	lb.
Warden (average of check plots)	4	10	2	22	Gresley	4	8	2	12
Zealand	4	5	0	4	Wagga No. 47	4	2	0	13
Marshall's No. 3.	4	4	0	15	Clarendon (average of check plots)	3	16	1	1
Cowra No. 20	4	2	1	25	Cowra No. 19	3	3	2	15
Bomen	4	1	2	22	Firbank	3	2	3	21
Hard Federation	3	17	1	5					
Yandilla King	3	11	1	1					
Warren	3	9	1	25					

Nyngan Experiment Farm.

J. DOUGLASS, Experimentalist.

VARIOUS experiments were carried out at this farm during the season 1920. For Nyngan the season was a very wet one, 12·30 inches of rain falling during the growing periods, and the variations between some of the plots was very small indeed, particularly in the ploughing and mulching experiments, which therefore have less value than in a season of more average conditions.

Wheat Variety Trials.

The object of this experiment is to discover the most suitable variety of wheat to grow in this district for (*a*) hay and (*b*) grain. The experiment was carried out this year in Block A, Paddock 4, which, like the other experiment paddocks, is running under a triennial rotation. The whole of the area was ploughed early in July, 1919, the soil turning up dry and cloddy, in good open condition for a long fallow. The spring-tooth cultivator was used to preserve a mulch, and the plots were uniformly cultivated on 16th December, 1919, 30th January and 3rd February, 1920. The fallow was free from weeds, and an excellent mulch was maintained,

The early plantings were made on 17th April, the seed-bed being too dry for germination. The late plantings were made on 31st May. In both cases superphosphate was applied at the rate of 30 lb. per acre, and Hard Federation was used on the check plots. The seeding in the early plantings was at the rate of 20 lb. per acre, and in the late plantings 27 lb. per acre

No seed germinated until June, and both plantings were germinated by the early June rains. In the early plantings, Sunset, Clarendon and Canberra germinated very well, while the selections from Hard Federation and Eckstees were very backward. Firbank seed from Cowra germinated much better than that produced at Nyngan; there were marked differences throughout the growing period. Among the late plantings the germination was again very good, occurring four or five days later than in the early plantings. Clarendon and Canberra were very good, the selection from Hard Federation was very backward, and most of the Hard Federation checks were very good. Both lots of Firbank germinated very well, and very little difference could be noticed between them.

YIELDS per acre, based on percentage.

Variety.	Grain.				Hay.							
	Early Planting.		Late Planting.		Early Planting.				Late Planting.			
	bus.	lb.	bus.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
Sunset	40	55	31	18	2	13	1	14	2	19	0	0
Canberra	37	0	38	36	3	5	2	14	3	8	3	14
Firbank (Nyngan)	32	16	25	42	2	14	2	14	3	13	0	0
Firbank (Cowra)	31	24	24	48	2	16	1	0	3	14	1	14
Selection from Hard Federation	31	5	27	36	2	11	1	0	3	10	1	0
Ecksteen	29	27	26	0	2	5	3	14	2	16	3	0
Clarendon	26	54	33	36	2	17	1	0	3	3	1	14
Improved Steinwedel .. .	24	20	22	30	2	6	0	0	2	15	3	0
Hard Federation (Average of check plots)	30	20	32	0	3	3	2	0	3	7	2	14

Ploughing Experiment.

The results in this experiment showed little variation as a result of the different treatments, sufficient moisture being present in the soil under all forms of ploughing to bring the crop to the greatest development possible under Nyngan conditions.

The average yield from the check plots (disc-ploughed, 6 inches deep) was 2 tons 19 cwt., and the increase or decrease from the various treatments did not in any case exceed the margin allowed to cover possible experimental error in tests of this kind. A detailed report is, therefore, not published. A summary of the results for nine years appeared in the *Agricultural Gazette*, December, 1920. The experiment will be continued.

Mulching Experiment.

This experiment has now been carried on for nine years, mulching with a number of different implements being tried in conjunction with a previous ploughing with either the disc or the mouldboard plough. Summarised results obtained by the several methods of mulching show very little difference: the outstanding facts are the superiority (1) of the mulched over the unmulched plots, and (2) of a fallow mulched some time before planting as compared with one mulched just before planting. One section of the experiment was designed to ascertain which month was most suitable for mulching, but the results from mulching in October, November, and December varied so slightly as to indicate no reason for any preference. The experiment has now been rearranged in the light of the information so far obtained, and will be continued.

Progress in Control of Animal Diseases.

A systematic campaign against tuberculosis in live stock was begun by the Department of Agriculture in the United States three years ago, with results that already show what can be done when scientific knowledge comes to be associated with organising powers. On 30th June, 1920, 3,370 herds were officially credited by the Department with being free from tuberculosis, which was approximately the number at the beginning of that year. In addition, 16,600 herds had successfully passed one test. During the year 695,000 animals were examined, of which under 30,000 reacted to the test, and had to be destroyed.

Applications for testing have accumulated more rapidly than they could be handled by the available veterinary officers, and near the end of the year 4,740 herds were on the waiting list.

Progress is also being made in the control of hog cholera, and it is estimated that already an annual saving of 41,000,000 dollars has been effected in relation to this disease.

Apples that are affected with the small black blotches on the skin, known as black smut, may be cleaned by rubbing each one in a handful of sand. A case of soft wet sand and a bucket of water is all that is required. After being rinsed in the water, the apples should be placed in a case or on a bench to drain.—L. Gallard, Fruit Inspector.

Elephant Grass, or Napier's Fodder.

E. BREAKWELL, B.A., B.Sc., Agrostologist.

SINCE the last article on this grass was published in the *Agricultural Gazette*, December, 1919, a good deal of further information concerning it has been obtained, and the time may be said to have arrived when it should be dealt with more freely, and the results finalised which have been obtained by the Department and by over 100 farmers who have reported on it in different parts of the State.

It is a native of tropical Africa, being confined to the area between 10 deg. north latitude and 20 deg. south latitude. Within this immense area it occurs mainly along watercourses and in marshy depressions, but also enters the bush and forests where open spaces afford sufficient light. Under favourable conditions it forms extensive reed jungles, as for instance in the delta of the Zambesi. In the interior of Sierra Leone, it ascends nearly to 2,700 feet, and near its southern limit, in Rhodesia, to 5,500 feet. In rich marsh land it attains a height of 21 feet or more, whilst on drier soils, as in the savannas of East Africa, its stalks are hardly more than 6 feet high. In Togoland it has been called Elephant Grass by the colonists, while in Rhodesia it is termed Napier's Fodder, after Colonel Napier. The first mention of the grass was made in 1905, when it was stated to be a good fodder for cattle. Pigler in 1908 described it as one of the best fodder grasses. (Kew Bulletin, 1912).

The Rhodesian Agricultural Department commenced to take up its cultivation in 1910, Colonel Napier co-operating. The latter tested it under severe conditions, and became fully convinced of its economic value.

A parcel of seed was obtained by the Agricultural Department in this State in 1914, and only one seed grew. The resulting single plant became the origin of all the areas now established at the experiment farms, in addition to the thousands of roots distributed to various farmers.

Description.—Elephant Grass (*Pennisetum purpureum*) belongs to the *Pennisetum* family, a near relative being Pearl millet (*Pennisetum typhoideum*). It is a coarse grass, and characterised by extremely rapid growth. Under warm conditions it will attain a height of 20 feet in a few months. It grows in tussocks, and stools considerably. The leaves are 2 feet or more long when fully grown and somewhat coarse, being similar to those of maize. In young plants, however, and in the growths that follow grazing, the leaves are soft and succulent. There is a fair amount of variation in the hairiness of the plant, in some cases the stalks and leaf sheaths being practically glabrous, while in others both are extremely hairy. This variation has also been noticed in Africa in the natural habitat of the grass. The stems, after reaching a height of over 6 or 7 feet, become hard and woody. It has been

found by analysis, however, that the feeding value of the mature stalks is comparable to that of maize stalk roughage. In most localities the grass flowers on maturity, but seldom sets ripe seed. On the Northern Rivers and in Queensland ripe seed is formed to a small extent. The flower heads have the characteristic bristles of *Pennisetum*, and are 4 or 5 inches long.

Adaptability to Soil and Climate.

To date Elephant Grass has shown itself adapted to the coast, tablelands, and the slopes, and in the far west it does well under irrigation. It will grow on all classes of soils, but gives the best results on alluvial, volcanic, or good sandy loams. As a proof of its wonderful aptitude for growing on poor country it may be mentioned that some coastal land just south of Newcastle, previously devoted to burrawang and useless scrub, has now Elephant Grass growing there in abundance, providing a considerable amount of good feed.

Fig. 1.—Elephant Grass at Hawkesbury Agricultural College—before being eaten off.

Good results have also been obtained on barren soils at the mouth of the Manning River, and it should prove useful in bracken or useless scrub country.

Everyone who has grown Elephant Grass has been impressed with the remarkable rapidity with which it develops. In the warm months of the year, if provided with plenty of moisture, it grows over 2 feet a week. Light frosts do not severely affect it, but continuous heavy frosts will kill the flag entirely, though without injuriously affecting the roots, for records from very cold localities show that it readily comes away again in the spring. In western districts it seldom reaches a height of over 6 feet, but stools

considerably, a single cutting producing forty or fifty stalks in a single season. As a consequence, it has produced at Cowra Experiment Farm a greater yield for the season than any other grass tried.

That this grass will stand a considerable amount of drought has been proved beyond all doubt at Hawkesbury Agricultural College, Cowra Experiment Farm, and in other localities. Hardly a plant was lost at the College during the great drought, and comparatively few were lost at Cowra during the same period. What Elephant Grass will not endure are the hot winds and the extremely hot surface of the red soil plains in the summer months, and it is hardly worth growing west of Narromine.

Fig. 2.—The same plot as in Fig. 1—after being eaten off.

Elephant Grass responds to a good rainfall, the conditions most favourable to it being those of the Northern Rivers, but it does not like cold swampy subsoils.

Palatability and Feeding Value.

The appearance of Elephant Grass is extremely deceptive. At first sight it looks unpalatable, but that it is not so is proved by official investigations under varying conditions, and also by the numerous reports submitted by farmers. Elephant Grass is not as palatable as many other well-known grasses, but that cattle will eat it and do well on it is beyond question. Its palatability appears to be greatest in its young, more succulent stages. When it reaches a height of 7 feet or over its woodiness is against it, though even under these conditions the softer ends of the stalks and leaves are readily eaten. Sheep appear to like the grass least of all when other grasses are about, but they will eat it and thrive on it when other feed is not abundant.

This has been the experience at Cowra Experiment Farm. The illustrations showing the grass at Hawkesbury Agricultural College before stocking and after stocking speak for themselves.

The chemical analysis of the grass was published in the *Agricultural Gazette* in July, 1917, it being shown there that the grass was most satisfactory as regards its food value. Analyses have also been made in connection with the growth that follows grazing and cutting, with the following results:—

	After cutting.		After grazing.
Moisture	14·27	Moisture	13·52
Albumenoids	11·28	Albumenoids... ...	11·97
Ether extract	1·65	Ether extract ...	1·20
Ash	17·55	Ash	9·95
Fibre	27·43	Fibre	31·94
Carbohydrates	27·82	Carbohydrates ...	31·42
Albumenoid ratio ... =	1:2·8	Albumenoid ratio =	1:2·8
Nutritive value ... =	42·8	Nutritive value =	46·0

The results show a slightly favourable margin for the grass under grazing.

Milk Producing Qualities.

At Hawkesbury Agricultural College the milk and butter-fat records of eight cows were taken while they were feeding on the Elephant Grass, and also during occasional periods when they were taken off the plot and allowed to graze on the natural pastures. These recorded twenty-eight milkings while the cows were feeding on the grass, and fifty-five milkings while they were off.

AVERAGE Milk Yields and Tests of cows at Hawkesbury Agricultural College.

	On Elephant Grass.		Off Elephant Grass.	
Number of Cow.	Average milk yield.	Average Test.	Average milk yield.	Average Test.
	lb.	per cent.	lb.	per cent.
162 ...	15·90	4·70	13·70	4·70
86 ..	13·38	4·98	11·90	5·23
348 ...	17·20	4·18	15·50	4·51
607B ...	15·57	4·91	14·05	4·94
239 ...	13·02	4·68	11·73	4·76
20 .	11·41	5·22	10·40	5·35
655 ...	12·29	4·44	11·19	4·66
5 ...	10·54	5·21	9·85	5·04

The results appear sufficiently conclusive that the milk yields and butter-fat tests are maintained on Elephant Grass. It might be added that the ordinary pastures of the College were in very good condition at the time the test was carried out.

How to Plant Elephant Grass.

Elephant Grass can be raised from seed, but such seed should be sown in a nursery bed, and the young plants transplanted to the permanent paddock. Early summer is the best time for sowing.

The best method of propagation, however, is by planting rooted slips or cuttings. The former can be planted in spring or autumn and the latter in spring only. The slips and cuttings have wonderful vitality, and a case is on record where certain cuttings, having been kept for over a month, were soaked in water before being planted, and a 60 per cent. strike resulted.

Cuttings should be obtained from the fairly-hard portions, and should have three nodes. They should be planted in cultivated ground, at distances of 3 feet apart. The slips can either be inserted in the soil with two nodes in the ground and one out, or shallow furrows can be ploughed 3 feet apart, and the slips or cuttings dropped horizontally in the furrows, and the ridged soil turned back upon the cuttings by reversing the direction of the plough.

Fig. 3.—Elephant Grass showing a month's growth after being pastured close to the ground.

Carrying Capacity.

A fodder that will produce 70 to 80 tons of green feed per acre in a season must necessarily have a good carrying capacity. It is very difficult to obtain the actual carrying capacity of the grass, owing to it having to be fed off at intermittent periods. It may be said that when 6 feet high it requires to be very heavily stocked to ensure it being eaten down. The cows should then be removed until the grass has made new growth. In the winter months no growth is made, but during the summer Elephant Grass will maintain ten to twelve cows per acre at periodical intervals.

Behaviour under Stocking.

As a rule stock eat the top leaves and stalks of Elephant Grass, and from the joints below several tender shoots spring out, and these are always appreciated.

Owing to its rapid growth in midsummer Elephant Grass often grows quicker than the stock can eat it, and when over 6 or 7 feet high it develops woodiness. Under these conditions a succulent growth can be induced by cutting the grass, not near the base, but a couple of feet above the surface of the ground.

The plants stool considerably, and in the second year it will probably be found that all available room is taken up. Experiments are now being conducted to determine the advantage, if any, of planting the roots at a greater distance apart, and filling up the spaces between with a vigorous creeping grass like Kikuyu Grass.

Fig. 4.—Elephant Grass at Cowra Experiment Farm.

The Testimony of Farmers.

It would be impracticable to quote the very many favourable reports (over 100 in number) received from farmers, but a selection of the testimonies will be of interest.

The Coastal Districts.

Mr. M. LAMB, MULLUMBIMBY.—Had three cuttings. Consider it better than cane because can get so many cuttings.

Mr. A. SMITH, DUNGOG.—Stooled in a wonderful manner. Cattle and horses ate it readily. At the first cutting there were five bundles from each plant containing as much as a man could got his arm around. At the second cutting in the same season it was 7 feet high.

Mr. A. CAMPBELL, BULLAHDELAH.—The weather was dry when the cuttings were put in, but they made much better growth than Indian cane alongside.

Mr. F. PILE, DUNGOG.—Stood up well during the late drought, even after the severe frosts of last winter, when it was cut down to the ground. Now, after the rains, the growth is excellent. I feel sure it will be a successful plant as a stand-by in dry seasons, but I think it will be best suited for growing in small paddocks and grazed off.

Mr. H. WILCOX, OURIMBAH.—Roots planted last spring (1919) on hillside land, which was a friable loam with chocolate subsoil. When 6 feet high the cows found their way in, and ate the crop down to the ground. Although Indian cane was growing alongside the grass very little of the cane was eaten. Recently we cut on an average seventeen stalks to a plant, about 14 feet high.

Mr. S. RUPRECHT, LANSDOWNE.—Has grown 9 feet high, and looks well and promising, and I think it will be good feed for stock. Several people have been to see it.

Mr. W. G. RICHARDSON, TOWRADGI, SOUTH COAST.—The plants are now about 10 or 11 feet in height, and I intend chaffing it for silo purposes. I have two sorts of grass, one has a broad leaf and thick in the stem, but does not flower or seed. The other grows something like sorghum, only it shoots out at every joint, is much taller than the other, and comes out in seed. They are both heavy yielders of fodder. Two calves kept the plot eaten down, and they did very well on it. I am keeping it eaten off.

Messrs. PALMER AND MCKENZIE, *viâ* EDEN.—Every plant grew. The cattle ate it right down when it was about 3 feet high. In the last fortnight it has grown over a foot, and has stooled tremendously.

Mr. W. GOW, MACKSVILLE.—Have had a most severe winter, coldest in memory, and many of the leaves of the grass fell off, but they still retained their juice, and when chaffed, horses and cows ate it greedily. When stalks get old stock do not care much for it, but are very fond of it when chaffed, and I am satisfied it is a better milk producer than the cow cane. It makes good sweet-smelling hay when cut 3 or 4 feet high, and provides good chaffed feed in winter when grass is scarce.

Mr. J. H. CURRAN, COPELAND.—Stock do not seem to care for it after it has reached 5 or 6 feet, if cut and fed the same day, but they eat it greedily after it has wilted for a day or two, no matter what size it is.

Good reports have also been received from Casino, Newcastle, Sydney suburbs, Bega, Gosford, Eden, Ourimbah, Milton, and Landsdowne.

The Tablelands.

Several New England growers report favourably concerning the summer growth of Elephant Grass, but little information is available concerning the manner in which it endures the cold winters there. The following is representative :—

Mr. F. THOMAS, DEEPWATER.—Roots planted in a rich loam on a river flat. On reaching a height of 2 feet I grazed the plot off, cattle taking readily to it, and evidently finding it very palatable. The roots stooled out well, and before winter some of the clumps were 7 feet high, and a foot or more in diameter. The first frost early in May touched the grass, and I cut it for hay. The grass was very coarse and tough, and the cattle ate it as hay, leaving the thicker stems. The winter frosts apparently killed a good percentage of it ; the best is now making excellent progress, being 2 to 3 feet high. It is a very rapid grower, but I think *Phalaris bulbosa** is better suited to the district.

Mr. F. N. WRIGLEY, GLENGARRY, GLEN ELGIN, *viâ* GLEN INNES, states that it did better than Sudan grass.

Mr. R. CHARD, near GLEN INNES, states that it reached 9 feet, with sixty or seventy stems from one root. I have seen nothing in fodder line to make such growth.

Mr. W. E. PARRY, SPRINGWOOD.—It was planted on new ground—a sandy loam of good depth with little or no manure. There has been dry weather since, but it has done well. It has stooled out abundantly, and in some cases there are forty or fifty stools to a plant. The cattle got in once and ate it down tight, and since November last I have cut it three times. The animals like it, and do not leave a blade in the feed box.

Mr. T. BARKER, THE ELMS, YARRA, GOULBURN.—Grew splendidly until the frosts cut it back, but it is now sprouting again.

There are also good reports from Leura, Taralga, Araluen, Tumbarumba, and other cold localities.

* This is true only for winter conditions.—E.B.

Western Districts.

More reports have been received from the western districts than elsewhere, and space only allows the inclusion of a few.

Mr. O. Whittle, Alloway, *viâ* Narromine.—Shoots from two grew 1 to 5 feet by December, and stooled fairly well. I cut one back to about 1 foot from the ground and now they are both the same height, viz., 8 feet, have over thirty canes each, and are still green and thriving. I put some in a grass paddock with a hoe. These are 3 feet high, have six canes each, and are still green. I planted some other roots at the water's edge of a cowal. These roots have stooled the same as those put in with a hoe, and are about the same height. There is no doubt about this grass thriving well under cultivation.

Mr. Douglas, Fairfield, Coonabarabran.—The grass is doing well; it has caused considerable comment locally, being grown on a sandy soil with practically no rain.

Mr. C. F. Sacker, Wallendbeen.—The plants have stooled to about twenty shoots. I planted them alongside a lucerne plot, and when the cattle were feeding off the plot they ate the grass with apparent relish. Will divide up the stools.

Mr. J. Parslow, Gilgandra.—The plants grew to a height of 4 feet and spread 2 feet across. Fed stalks to horses, cattle, and pigs, and they were readily eaten. In the spring the grass came away well again.

Very favourable reports have also been recieved from Gulgong, Denman, Albury, Yarramalong, Dubbo, Mudgee, Yanco, Tamworth, Binnaway, Dyer's Crossing, Warialda, Singleton, Gundagai, Boorowa, Quirindi, Gunnedah, and Boggabri.

Summary.

1. Elephant grass can be treated either as a fodder or as a pasture grass. As a fodder it is not recommended for situations where maize or other summer crops will grow, but it will produce most satisfactory results on poor soils.

2. Elephant grass should be cut or pastured before reaching a height of six or seven feet; the succulence of the plant improves considerably under grazing.

3. Elephant grass produces greater fodder yields in our coastal districts than any other plant known.

4. It is an excellent grass to grow in our wheat-growing districts for summer feed.

5. Records from Hawkesbury Agricultural College, and also from the United States, show that cows maintain their milk yield when pastured on Elephant grass.

Propagating Mushrooms from Natural Spawn.

The mushroom spawn that is sold in bricks can sometimes be induced to start growing, though apparently old, by thoroughly moistening it and keeping it warm.

Spawn may be produced by taking a number of mature mushrooms and placing them in a manure bed, and covering them over with about 3 inches of manure. It can also be produced by digging up the soil around the spot where mushrooms have grown naturally in the field, and transferring it to a manure bed.

The manure bed must be made from fresh manure containing straw, and must be well fermented and aerated. The spawn should be placed in the bed when the temperature is 80 deg. Fah.—G. P. Darnell-Smith, Biologist.

The Feeding of Sheep in Times of Drought.

[Continued from page 386.]

[At the termination of the 1919–20 drought, circulars were issued by the Stock Branch with a view to the collection of information on the methods of feeding sheep during the preceding months of scarcity. Valuable information was provided by several stock inspectors and others, particularly by Mr. C. J. Woollett, Stock Inspector at Tamworth. From these replies and other sources, the following excellent article has been compiled by Mr. W. L. Hindmarsh, B.V.Sc., M.R.C V.S., D.V.H., one of the veterinary officers of the branch.—S. T. D. Symons, Chief Inspector of Stock.]

We may now proceed to discuss the various fodders used during the drought, and to quote extracts from the replies of various graziers to the questions asked by the Stock Branch.

Scrub Feeding.

The varieties of native scrub and trees available for feeding stock in drought depend on the districts affected. Probably the best known are kurrajong, wilga, mulga, myall and willow; others not so palatable but extensively used are apple, box, rosewood, boree, pine, &c. Certain drought-resistant plants, such as saltbush, &c., are not included in this category, since they are the natural sheep food of the western districts. It is a matter of regret, as some stockowners are beginning to realise, that these natural fodders should have been so ruthlessly cut out. Even when being cut for sheep it was noticed that in some cases, instead of being lopped the trees were felled, thus destroying their future usefulness, not only as food but as shade and shelter.

It must be borne in mind that these are only emergency fodders. They do not provide a balanced ration, and while alone they may keep up the health of stock for a limited period, eventually condition will be lost and signs of digestive disturbance be noted. In any case they are entirely unsuited to lambing ewes. Their value is much increased by—

(*a*) The addition of small amounts of grain daily, say, 4 to 8 oz. per sheep.

(*b*) The addition of salt, epsom salts, and molasses in the form of a lick. This acts as a corrective, and lessens the liability to impaction of the digestive organs. The proportions might be 1 part epsom salts, 3 parts Liverpool salt, 4 parts molasses. The amount of epsom salts might be increased if deemed necessary. Sulphate of iron, although it is recommended as a good tonic in normal seasons, should not be used, as it is an astringent and increases the liability to constipation.

(*c*) Adding a little hay to the above ration. If hay is added even only once or twice a week the stock would resist the adverse conditions more successfully.

It will be noted that in some cases sheep do not relish the scrub when freshly cut, but later, when it is drier, they eat it readily. From the replies received from graziers on this question of scrub feeding we make a few extracts, grouping them according to the portion of the State from which they come, and devoting a separate paragraph to each reply quoted. It will be seen that they emphasise the fact that scrub is only an emergency fodder, and that it must be accompanied by other food if the scrub feeding is continued over an extended period. The italics are our own.

Northern Tablelands.—We started to feed on box leaves in March, 1919, and continued until December. There was a bit of dry feed to pick up for the first six months, but after that they only had box leaves. We gave them plenty of salt and epsom salts. *The ewes in lamb died first; we lost half of our sheep.*

For two years I lopped box leaves for 300 Merino sheep. They were doing fairly well until the heavy rains came. I have *only* 170 *left, and have not had any lambs for two years.*

I fed 1,000 sheep for twelve months on white box leaves *without any loss.* I also gave them 4 *to* 5 *quarts of molasses* twice a week in their water trough. The sheep were Lincoln crossbreds.

I fed about 400 ewes in lamb on mixed scrub. About the *time they started to lamb they commenced to die. I do not think I saved* 50 *ewes* and got one lamb.

We fed dry sheep in good condition—two-tooth to six-tooth—on box and apple leaves. We frequently *changed the paddocks.* The sheep were kept *in small lots,* and we frequently lopped for them. A plentiful *supply of salt* was given—*results were good.*

Far West.—Scrub was mulga, but leaves were very dry. The stomach became impacted with dry food. *Deaths from dry bible were frequent.*

Other Reports.—During winter, 1919, we fed 600 ewes on apple-tree from March to December and kept them in good condition without many losses. We *only marked* 5 *per cent. of lambs.* We kept the sheep well supplied with a lick of 30 lb. Liverpool salt and ½ lb. of epsom salts.

I fed lambing ewes on kurrajong, and only lost 10 per cent. of grown sheep. *Lambs all died in seven to ten days.*

I find that ewes and lambs will thrive on kurrajong provided they are supplied with sufficient quantities. *During pregnancy I think something else is required with it.*

Ensilage.

The necessity of conserving the natural fodder which makes such abundant growth in the pastures in good seasons has constantly been emphasised by the Department. While most stockowners will agree as to the wisdom of this course, few attempt to put the principle into practice, and forage that would help to carry stock over a dry season is still allowed to go to waste. It is well understood that in some parts, owing to the nature of the ground and herbage, and the presence of fallen timber and stones, it is not possible to use farm machinery to get the crop off. Where it is practicable, however, the farmer should never fail to turn the surplus growth into ensilage, and thus insure himself in the most economical way possible against drought. According to the district and season, prolific growth of trefoil, marshmallow, variegated thistle, crowfoot, and other herbage might well be utilised for the making of silage. Where the sheepowner is in a position to do it, silage can, of course, be made from most of the green crops usually cultivated. Maize, sorghum, lucerne, wheat, oats, and various grasses have all given successful results.

In one case only was the feeding of ensilage to sheep reported upon adversely, and then no particulars were given. Against this is the fact that numerous graziers reported excellent results. Not only did the sheep keep up their condition but the ewes produced sufficient milk to rear the lambs. The cost of the preparation of silage is small compared with the cost of hay and other feeds in dry seasons. In one case recorded, the cost of pitting was 11s. a ton.

Feeding should commence while there is still a little dry feed about, and about 1 lb. should be given daily. This quantity can be increased as required up to 3 lb. per sheep per day, which is sufficient to keep the sheep in condition. Where practicable, the addition of a little grain twice a week is an advantage.

The example set by the contributors of the following reports might well be emulated. The paragraphs are taken from the letters received from sheepowners in the districts mentioned, each paragraph being an extract from a separate letter :—

Southern Tablelands.—I fed 2 lb. of lucerne ensilage to lambing ewes daily. Fed by trailing. The ewes did well—*marked 80 per cent. lambs.* There appears to be nothing like lucerne ensilage for lambing ewes.

The best results were obtained by feeding for four days on ensilage and three days lucerne hay per sheep. Three thousand ewes marked 43 per cent. of lambs with a loss of only 90 ewes.

Northern Tablelands.—Fed up to 3 lb. ensilage daily to sheep. The ensilage was made of trefoil, borang, and variegated thistle, having been pitted two to three years, each pit containing 250 tons. Was sweet smelling, and partaken of readily by sheep. Fed to 12,000 sheep for twelve months. They *marked with excellent results.* Ewes and young lambs do well on it. *Ewes show plenty of milk,* and hold fair condition.

Riverina.—In suitable places, such as frontages to a creek, almost unlimited quantity of grass can be cut in good seasons and made into hay or ensilage at a minimum of cost. Both methods have been tried here with good results.

Central Plains.—Ensilage, with a little grain, is best of all for feeding sheep.

Hay, Chaff, and Straw.

On the whole these have not been reported upon favourably as fodders for sheep when used alone. The consensus of opinion is that hay feeding is not economical, as it is scattered and trampled into the dust when fed; moreover the initial expense is very great if it is purchased at drought prices. Chaff may be fed from troughs, but it is liable to be blown about and to get into the sheep's eyes unless damped. These fodders are of course preferable to scrub and some good results have been reported in dry sheep, but almost nvariably stockowners have stated that on lucerne, oaten or wheaten hay, ewes (even if they keep fair condition) do not secrete sufficient milk to rear their lambs.

With the addition of some grain and damped with brine or molasses and water better results have been obtained, as in this case the ration contains more nutriment material and the salt and molasses help to correct the constipating effect of a continuous ration of dry food. While one stockowner claimed to have reared 75 per cent. of lambs when hand-feeding lucerne hay—

possibly local conditions were of assistance—other reports mention the marking of 10 per cent. and 12 per cent. lambs after ten weeks' feeding on similar fodder.

Bush hay may be cut and stored from the natural pastures. It is common to see fine crops of native grasses allowed to go to seed and dry up, when with a little labour they could be saved and stored. While such hay is not so satisfactory as ensilage (which contains much of the original moisture), it would nevertheless be the means of saving stock during a dry season.

Straw is a food that is much neglected in our wheat-growing districts; while its nutritive qualities cannot be compared with those of hay, its value is very great as an emergency fodder. Although it is appreciated, of course, that even straw that is not stored performs a useful service if it is returned to the soil, it must still be urged that if some of it were saved it would be of incalculable value to the sheep in time of drought. Soaked in or sprinkled with molasses and water, straw will readily be taken by sheep. One owner stated that he fed his sheep on bales of straw which were soaked overnight in a mixture of molasses and water. The excess fluid was drained off and the unopened bale placed in the paddock and sheep ate it readily. Where possible the straw should be steamed immediately before using to make it more palatable. Grain is a necessity with any hay or straw if the sheep are to be kept in condition.

The following paragraphs are taken from the letters received from sheep-owners in the districts mentioned, each paragraph being an extract from a separate letter:—

Northern Plains.—Starting on a small ration of lucerne hay, up to 3 lb. was given daily per sheep. This gave good results. Breeding ewes fared exceptionally well. *Young lambs up to four months did not do well,* developing digestive troubles. Chaff was tried, but was far from successful.

Central Plains.—Lucerne hay I found a failure; all the leaf was broken off in pressing, and no nutriment in the stalks. Best results from oaten hay.

Northern Tablelands.—In 1917 I fed 1,500 weaners on lucerne hay, but it was not a success. They got 1½ lb. per day each, but, although there was a lot of dry feed in the paddocks *we lost 460 in sixteen weeks. They were poor when we started to feed and affected with worms.*

I was feeding 350 ewes on lucerne hay during March and April, 1918, allowing 1¼ lb. daily. The ewes lambed all right but did *not have much milk,* the result being that all the *lambs that were not old enough to live on hay died.*

I fed lambing ewes on good lucerne hay at the rate of 1½ lb. per head per day. I marked 50 per cent. lambs.

I fed 2,000 sheep on 25 tons of lucerne hay for a few weeks with poor results. The strong sheep took to it readily, and the *poor ones died* before they could eat enough to do them any good, *particularly young sheep.*

I fed 400 ewes while lambing for four weeks on 2 lb. of lucerne hay each daily. The ewes did well and *had plenty of milk* for the lambs.

In 1919 I fed 500 Merino ewes on good lucerne hay—1 lb. per head per day. They did remarkably well. But the *increase all died,* as the *mothers seemed to have no milk after four to five days.*

New England.—Two-hundred weaners and young sheep were fed on red clover hay. The sheep kept in strong condition.

Grain.

Feeding on grain was carried out extensively during the past drought. Grain food has many advantages, possibly the most important being that it is concentrated and is easy of transport, but as already pointed out, grain alone is not a good fodder unless the stock can pick up some roughage to make up the bulk of the food. Hay, scrub, dried grass, and leaves all help to keep the digestive organs active, and farmers reporting good results attending hand-feeding with grain usually stated also that some roughage was available.

Generally speaking, maize has given the best results; as a drought food it is superior to other grain. Four ounces daily appears to have been a usual ration per sheep, but this is rather small, and 8 oz. daily is much to be preferred. In other countries, where hand-feeding of sheep to fatten for the market is a routine procedure, maize and lucerne are the most popular articles of diet. Hence it is not surprising that maize and ensilage and maize and lucerne hay have produced good results during the recent drought in New South Wales.

The question of crushing or soaking the maize has also received attention. A healthy adult sheep should be quite capable of masticating the grain without treatment, but where the sheep are young or poor it is advisable to soak the grain so that it may be more easily assimilated. The disadvantage of soaking is that if fed from the ground the dust and dirt adheres to the grain and is ingested. To some extent this may be overcome by soaking in a limited amount of water, so that all the moisture is absorbed. Soaked grain should be fed at once as it will become sour if kept for any length of time. If it is desired to break the maize it should only be cracked—not ground.

The following reports are of interest:—

Fed fifty old ewes on dry grass and maize—Reared forty lambs.

Fed 200 lambs on boiled corn and bran—Loss of only 5 per cent.

Fed 6,000 ewes three months on ½ lb. hay and ½ lb. corn daily—Reared 75 per cent. lambs.

Fed 8,000 ewes on 1½ lb. lucerne hay and ½ lb. corn—Reared 10 per cent. lambs.

Fed 8,000 ewes on lucerne hay and maize—Marked 10 per cent. lambs; lost 12 per cent. ewes.

Wheat was also largely used for hand-feeding during the last drought, but with this, as with maize, some roughage is required. The results were by no means so good as with maize and there was always the danger of the sheep picking up earth and sand with the grain. Soaking the wheat beforehand is not an advantage, unless some medicament (salt, molasses, &c.) is added to the water. It is not so nutritive for sheep as maize and is less economical, and in few cases did young sheep thrive or ewes rear a big percentage of lambs when fed upon it. As with other feeds, adult dry sheep kept in fair condition in many instances.

Experience with oats and barley is somewhat similar to that with wheat. Barley, however, is hard to masticate and should be crushed before using.

The following paragraphs are taken from the reports received from sheep-owners in the districts indicated, each paragraph being an extract from a separate letter :—

Northern Plains.—Corn up to ¾ lb. per day per sheep was given alone and sometimes with chaff. May be good as a change, and no doubt acts well for a short time, but if continued over four weeks is usually attended with losses, especially in young sheep.

One lot of 900 ewes that were dying were fed on corn for ten weeks and marked 75 per cent. of lambs.

Central Plains.—My opinion is that corn is by far the best artificial food for dry sheep and that if given ½ lb. per head per day they can be kept strong, with practically no losses for a considerable period.

Far West.—Fed wheat from troughs. It was not satisfactory.

Northern Tablelands.—Fed 590 crossbred ewes on wheat. Gave 3 oz. first week, and then 4 oz. daily. Fed from June to September. The paddock had been heavily stocked, but some trefoil burr was left. *The loss of ewes was less than normal, but half the lambs died.* I only marked 45 per cent.

Twenty thousand ewes were fed on wheat, 3 to 4 oz. daily, for three weeks, and the quantity then increased to 8 oz. per head daily. Fed by trailing. The ewes did well: loss of 5 per cent. from sand ingested. *Lambing was a failure.* Of opinion that wheat by itself is useless—*the sheep must have something to fill up upon.*

I found that crossbred ewes in lamb kept strong if given 4 oz. of maize daily, also the ewes did better if corn was soaked some time before being used. *I do not like feeding on grain alone*, but *always give the sheep a few leaves of some sort.*

I fed 300 lambing ewes on corn broadcast, ¼ bushel a day. I did *not save many lambs, but I saved the ewes.*

I have fed sheep of different ages on corn, broadcasting it. I found large heaps of corn on the sheep camps. *They seem to have trouble in chewing it.*

Four hundred ewes in lamb, *low in condition*, were given 6 oz. of corn daily, broadcasted, costing 1d. per day per sheep. In a short time there *was a marked improvement*, but though *lambing well they make no milk*, and I only *marked twenty-eight lambs.*

In 1918 I fed 150 fat ewes about to lamb which were dying of paralysis. I gave them 3 oz. maize daily, then 1½ oz. After two days they stopped dying. I fed 4,500 travelling sheep on corn, ¼ lb. per day each. Losses were only 2 per cent. per month.

Southern Highlands.—Feeds mostly used were lucerne hay, oaten hay, and maize. Of these maize gave the best results. It is easily handled, and sheep took to it readily and picked up every grain, there being no waste. The quantity used varied from ¼ lb. to 1½ lb. per day, and the method generally adopted was to divide the sheep into as small lots as possible with the paddocks available, and then just scatter the maize on the ground. One lot of 4,000 sheep fed in this way for two months did well. They were in only two lots, 1,000 of the weakest being separated from the strong ones. They improved during the time they were being fed.

(*To be continued.*)

Orchard Manuring Experiments at Bathurst.

The manurial experiments which have been carried out at Bathurst Experiment Farm orchard for the last four years have now been concluded. No benefit has been apparent from the use of the manure used (blood and bone broadcasted in quantities varying from 4 to 10 cwt. per acre), and it would appear from the results obtained that the soil at the Bathurst orchard is still sufficiently rich for fruit-growing without manure, providing the rainfall is sufficient. Advantages from the use of manures may yet become apparent.—W. J. Allen.

The Modern Cheese-curing Room.

AN INTERESTING COMPETITIVE COMPARISON.

A. T. R. BROWN, Assistant Dairy Instructor.

To appreciate the effect on quality of cheese matured in a good curing room, one requires to see the difference in quality and weight of the same cheese when ripened in an indifferent curing room.

In one of the cheese classes at the recent Bega show this was the end in view, as well as the placing of every competitor on an equal footing as regards the ripening of the cheese under the same conditions.

On a given date in November, 1920, seventeen of the far South Coast factories forwarded to the Bega Show Committee, a seven-days-old cheese, unbranded, to be marked and forwarded to Kameruka to ripen for three months, each factory at the same time keeping one of the same day's make, and ripening it in the curing room of the factory where it was made.

On the 22nd February, 1921, three months later, the cheeses ripened at Kameruka were judged and awarded points by Mr. C. Davis, formerly Manager of Kameruka Niagara Cheese Factory. The same evening, the factories forwarded the cheeses ripened in their own rooms to the Bega Show Committee, to be examined and have points awarded by the same judge. When comparisons were made, it was found that, with one exception, the cheese ripened at Kameruka scored higher points than those ripened at the various factories. The exception was later on found to have been cured in a local chilling room by mistake.

The results were as follows :—The winning place went to Warragaburra Cheese Factory (W. Riley, cheese-maker), the cheese scoring 94½ points. The duplicate of this cheese ripened at Warragaburra scored 92 points. It is interesting to note that this cheese was made from pasteurised milk. In an unpasteurised entry the cheese from this factory only scored 92 and 91 points respectively.

The second place went to the Elmgrove Cheese Factory (A. Peters, cheese-maker), scoring 94¼ points; its duplicate ripened at Elmgrove scored 92 points.

The third place was divided by Erinna Co-operative and Moruya Co-operative Cheese Factories, scoring 94 points each. The duplicates of these scored 93 and 92 points respectively. It is interesting to note that the Moruya cheese was made from pasteurised milk.

The competition was carried out in the three most trying months of the year to test the effectiveness of the different curing rooms, and the result of the competition fully warranted this step. Erinna curing room gave test results next Kameruka, but there was a marked difference between the quality of the cheese ripened at some of the smaller factories.

The far south has always prided itself on the consistent and uniform quality of cheese that some of its factories turn out. Giving only due praise, pride of place in this respect should go to Kameruka Estate, and on sifting out the reason for its success, it is apparent to both the expert and casual visitor that it is due to cleanliness at the dairies, solid application and adherence to detail in manufacture, and lastly, to the consideration given to ripening the cheese in a proper curing room where a system of control gives an almost even temperature throughout the year. It was for this reason that the Kameruka rooms were chosen to carry out this scheme.

The new cheese suffered most in December when there was a general heat wave for a few days; I had the opportunity of visiting some of the factories storing the duplicate cheeses, and the temperature of several of these rooms ranged up to 90 degrees Fah. The texture of the cheese stored in these rooms suffered accordingly, the cheese also loosing unduly in weight. The Kameruka rooms were barely affected by such heat, partially on account of the use made of a sub-earth air vent for creating an underground draught in the curing room. When used with discretion most beneficial results are obtained from this device, and I fail to see why so few factories use it, when they are so favourably situated to have the device built in.

The result of the competition gives a two-fold lesson; first, that better cheese results from even maturing in a properly insulated room holding an even temperature; secondly, that for mixed milk as in co-operative factories, pasteurisation greatly assists in giving uniform quality.

On account of the Kameruka rooms being used for the competition, the Kameruka Estate did not put an entry in.

Grass and Clover Plots at Orange.

Reporting in the middle of April with regard to certain grasses and clovers that were sown on his property last spring, Mr. W. Brown, "Avondale," Orange, remarked that the autumn growth was well advanced, and those likely to provide good winter pasturage were to some extent indicated.

The most promising of all the grasses for winter feed was Toowoomba canary grass (*Phalaris bulbosa*), which Mr. Brown considered the best winter grass in the Orange district.

Tall oat grass (*Avena elatior*) and giant fescue (*Festuca arundinacea*) were giving good results, as were cocksfoot, Kentucky blue, and perennial rye. A plot sown with a mixture consisting of 8 lb. giant fescue, 4 lb. tall oat, and 3 lb. white clover looked particularly good.

Of the clovers, ladino (*Trifolium repens* var.), an improved type of white Dutch clover, was showing considerably greater growth than the ordinary white Dutch. Chilian clover (*Trifolium pratense perenne*) was very bulky, and carried a lot more growth than Bokhara clover (*Melilotus alba*).—J. N. Whittet, Assistant Agrostologist.

A New Method for Determining Yields of Experiment Plots.*

H. WENHOLZ, B.Sc. (Agr.), Inspector of Agriculture.

In the establishment of crop experiments with varieties, fertilisers, &c., a piece of land is chosen if possible which is, on appearance, uniform throughout. It is, however, difficult to say definitely, even though appearances indicate it, that the whole of a field is identical in fertility, and in the many other factors which affect yield. That is to say, that if a certain field of several acres were sown throughout to the same crop and given the same treatment right through, and then divided into plots or sections of equal area, each of which was harvested separately, the yields of these plots would show unexpected differences, which must largely be caused by invisible differences in the soil.

In a comparative experiment in which, say, several fertiliser mixtures are being tested, one or more plots with no fertiliser are included as "comparison" or "check" plots. If these check plots are few in number in comparison with the total number of plots in the experiment, they will be widely distributed, and there is likely to be found a comparatively large variation in their yields, due to lack of uniformity in the land. If the check plots are frequent and systematically distributed throughout the experiment, the differences between adjacent check plots will not usually be so great.

With comparatively few check plots it cannot reasonably be assumed that the soil varies uniformly between them, but with frequent check plots—say alternately or every third plot—this assumption cannot be considered to be inordinate. Alternate check plots are the ideal, but as this frequency increases the area for the experiment (which is often limited) or decreases the size of each plot in the test (which is also inadvisable on account of its greater probable error), a wider distribution of the check plots to every third or fourth plot is most often used. Where the land is carefully selected in the first place, and with long narrow plots, the system of having check plots every third plot may be considered to be sufficiently accurate in most cases to assume that the land varies uniformly between these check plots. The method used, then, to show the difference between the various plots in the test, is seen from the following example:—

No. of Plot.	Treatment.	Yield per acre.
		bushels.
1 (*check*) ...	No manure	70·5
2	½ cwt. superphosphate per acre...	79·35
3	1 " " " ...	79·65
4 (*check*) ..	No manure	66·0
5	1½ cwt. superphosphate per acre	77·76
6	2 " " " ...	77·5
7 (*check*) ...	No manure	60·0

*Paper read before the Agricultural Section of the Australasian Association for the Advancement of Science, Hobart, 1921.

Without consideration of the check plots, the yields appear to be in order of merit as follows :—

Treatment	Yield per acre in bushels.
1 cwt. superphosphate...	79·65
½ "	79·35
1½ "	77·76
2 "	77·5
No manure (average of 3 plots)	65·5

To express the results in this way is obviously wrong, for judging by the yields obtained from the check plots, the land becomes slightly less fertile as we proceed from Plots 1 to 7. The result is that the 2 cwt. superphosphate plot is situated on less fertile soil than the 1 cwt. superphosphate plot, and cannot make an actual yield equal to it. Some correction must be applied to obtain correct comparative yields. With the justifiable assumption, then, that the land varies uniformly between the check plots under the aforesaid conditions, the "natural" yields of the plots are seen from the following :—

No. of Plot.	Actual yield per acre.	Natural yield.
	bushels.	bushels.
1 (*check*) ...	70·5	70·5
2	79·35	69·0
3	79·65	67·5
4 (*check*) ...	66·0	66·0
5	77·76	64·0
6	77·5	62·0
7 (*check*) ...	60·0	60·0

Taking these figures, some of the American experiment stations give the increase (or decrease) due to treatment as the difference between the actual and the natural yields for each plot. It is apparent, however, that this difference cannot be regarded as strictly comparative, as it depends not only on the actual yields obtained, but on the location of each plot in the experiment. The only true method of comparing the results due to treatment is to compare the "percentage yields"; that is, the percentage the actual yield is of the natural yield of each plot.

This is given as follows :—

No. of Plot.	Actual yield per acre.	Natural yield.	Percentage yield.
	bushels.	bushels.	
1 (*check*)	70·5	70·5	100
2	79·35	69·0	115·0
3	79·65	67·5	118·0
4 (*check*)	66·0	66·0	100
5	77·76	64·0	121·5
6	77·5	62·0	125·0
7 (*check*)	60·0	60·0	100

From this it is seen that the order of merit of the different methods of treatment is:—

Treatment.	Percentage yield.
2 cwt. superphosphate	125·0
1½ ,, ,, ...	121·5
1 ,, ,, ...	118·0
½ ,, ,, ...	115·0
No manure	100·0

This method of presenting the results of an experiment has been used by the New South Wales Department of Agriculture for many years, but it has two serious drawbacks. Although presenting the results in their correct order of merit, there is no means of determining the profit per acre due to any treatment. Again, the column of percentage yields, which really determines the comparative merits of the different treatments, is difficult to understand by many farmers who look to see the yields in amount per acre. As previously shown, a wrong conclusion is arrived at by farmers who follow this column of actual yields per acre.

The problem, then, is to give the results in yield per acre, and, at the same time, express them in strict comparison and due order of merit. To do this, it is apparent that the computed yield per acre for any treatment must be based on the percentage yield of that plot. It is seen that 2 cwt. of superphosphate per acre gives an increase of 25 per cent. over no manure. How can this be expressed in bushels per acre? This is of importance, for the two reasons given above; but, also, if such an experiment is continued over a series of years, the average yield per acre for each treatment must be given. Obviously, the actual yields per acre cannot be averaged, as they ignore the check plots and are wrong; nor can the percentage yields be averaged, because the high yields per acre of a good season would not exert their just influence on the average.

Now, the average of the natural yields throughout an experiment really represents what the plot of ground would have yielded per acre if it had been sown throughout to the check plot—in this instance, no manure 65·6 bushels per acre. Also, the yield which would have been obtained from each treatment if sown over the whole land on which the experiment was conducted is the percentage yield of the plot multiplied by this average of the natural yields and divided by 100. In the example under review, the results of the experiment are, therefore, as follows:—

Treatment.	Yield per acre.
2 cwt. superphosphate ...	$\frac{125 \cdot 0}{100} \times 65 \cdot 6 = 82 \cdot 0$ bushels.
1½ ,, ,, ...	$\frac{121 \cdot 5}{100} \times 65 \cdot 6 = 79 \cdot 7$,,
1 ,, ,, ...	$\frac{118 \cdot 0}{100} \times 65 \cdot 6 = 77 \cdot 4$,,
½ ,, ,, ...	$\frac{115 \cdot 0}{100} \times 65 \cdot 6 = 75 \cdot 4$,,
No manure	65·6 ... ... 65·6 ,,

If the difference between the actual and the natural yields is taken to be the increase in yield due to treatment (as is done by many American experiment stations), we have in this instance an increase of 15·5 bushels per acre due to the application of 2 cwt. superphosphate.

By this new method of expressing the results, this same increase is 16·4 bushels per acre. This difference is caused by the fact that the 2 cwt. superphosphate plot was situated on slightly less fertile soil than the average of the area on which the experiment was conducted. The latter figure (16·4 bushels increase) must be considered more exact, for it represents the average increase obtained on the average of this area.

This method of computing the results of experiments, with a slight modification, has been officially recognised by the Experiments Supervision Committee of the New South Wales Department of Agriculture, and the results of all future experiments of this Department will be computed in this way. The modification referred to consists in taking the average yield of the check plots, instead of the average of the natural yields throughout the experiment, and computing the acre yields as before.

In the different States of Australia where check plots are used at varying intervals in experiments, some uniform system is needed for evaluating the published results, especially as experiments by one State may be expected in some cases to apply to neighbouring portions of another State, and because different conclusions may be arrived at according to the methods employed in computing the results.

Feeding Syrup to Bees.

When dwindling is noticeable in a colony, the best syrup to feed to the bees is sugar and water in equal quantities by volume, stirred and brought to the boiling point, and fed warm (not hot) to the bees inside the hive.

A good method used in feeding is to remove one or more empty combs, and pour the syrup into the cells with a sprinkler, such as a tin with holes in the bottom. The combs so filled are then replaced in the hive. The work is usually carried out toward the late afternoon, and the filling of the combs is done indoors.—W. A. Goodacre, Senior Apiary Inspector.

More Experience with Kikuyu Grass.

Mr. J. T. Robilliard, Tingba, described his experiences to date with Kikuyu planted last August thus:—"This grass stood the dry weather remarkably well, and held its own against the summer grass. The stock eat it readily. Some roots were also planted in a poultry run, and though the fowls gave it a very bad time, the majority of the grass is still alive. I am still planting roots of Kikuyu in the grazing paddocks, where, notwithstanding the dry and hot spell, it seems to take readily. I should say it would be an ideal pasture grass for sheep. So far it has had no frosts on it, and I am waiting to see how it will stand our rather severe winter. . . . . Mine was planted on sandy (granite) soil."

The Cause of Black Disease and its Method of Transmission.

BEING FURTHER STUDIES IN A BRAXY-LIKE DISEASE OF SHEEP.

[Continued from page 402.]

SYDNEY DODD, D.V.Sc., F.R.C.V.S., Lecturer in Veterinary Pathology and Bacteriology, Veterinary School, The University of Sydney.

The Causal Organism of Black Disease.

Morphology.—The organism is one of the larger sporing bacilli. Its length varies considerably, depending on the element on or in which it has been growing. Its breadth is, however, fairly constant. In the natural hepatic lesions its length is from about 4 to 8 microns, with numerous filamentous elements up to 60 microns, without apparent division. The length of the majority of these filamentous forms is, however, about 30 microns. Occasionally chains composed of three or four shorter elements are encountered, but single rods are in the majority. The ends are distinctly rounded. The breadth is about 0·8 to 1 micron. Scattered among the before-described forms may be seen here and there short bacilli, about 2 microns long, and also even what at first sight appear to be coccus-like elements. These latter, as already stated, are merely the ends of the longer rods, standing at right angles in the section. The short rods are the ordinary bacilli lying obliquely to the line of vision in the section, as may be readily demonstrated by altering the focus of the microscope, the rest of the rod then coming into view, whilst the former part disappears. The filamentous elements are almost always to be found arranged around the periphery of the lesion—often in masses—near the leucocytic zone. The bacilli scattered throughout the body of the lesion are of the shorter type.

In cultures the bacilli usually occur singly or in pairs. No chains are formed, and only an occasional filamentous element is seen. In liquid media their length is from about 4 to 7 microns, and their breadth from 0·8 to 1·2 microns. Occasionally rods up to 10 microns occur, but they are seldom less than 4 microns long. In primary cultures from the muscle of inoculated sheep in serum-formate broth, bacterial forms up to 17 microns long are frequently seen. Involution forms often occur when the media or surroundings are unfavourable. In smears taken from the local lesion of experimentally infected animals the bacilli vary from 2·5 to 7 microns in length, but their breadth, as in other cases, remains fairly constant, viz., about 1 micron. The longer bacillary forms predominate but there are no chains or filamentous elements. The organism is non-motile.

Spores.—These are almost invariably situated terminally or sub-terminally, and are distinctly oval, measuring about 1·75 to 2·75 by about 1·25 microns. They distend the bacillary rod. Spores are not often found in the lesions if the latter are fixed directly after death, but they will be found if there has been a few hours delay in fixation. They are readily formed in media containing serum, but very few in any media containing glucose.

Staining reactions.—The bacilli stain with any of the basic aniline dyes and are Gram positive; but in sections, if the tissue has been preserved any length of time, the contained bacilli cease to retain the stain by the method of Gram or Gram-Weigert, or retain it only feebly. By the Claudius method they stain a deep purple. For the demonstration of the bacteria in sections, the latter has been the method of choice, as the decolorisation of the tissue elements can be carried to a considerable length without decolorising the organisms. In sections also, the Giemsa and Kühne-Nicolle methods have given good results, but more care has to be observed in the manipulation.

Occurrence in the body.—In naturally occurring cases, if the autopsy be held immediately after death, the baccilli will be found confined to the hepatic lesion or lesions. The unaffected liver tissue, other organs, exudates, blood, &c., appear to be quite free from them, even on cultivation. Consequently the condition is really a toxæmia. There is every reason, however, to believe that invasion of the adjoining liver tissue, and possibly the blood, may take place soon after death, together with invasion from the intestines of cadaver bacilli. Invasion by the latter, of course, invariably occurs unless the tissue is removed directly the animal dies. In two cases where the post mortem was unavoidably delayed for about an hour, microscopical examination of the affected liver showed that the bacilli in the necrotic lesion had already begun to extend through the zone of reaction into the unaffected liver substance.

In experimentally infected cases, the disposition of the causal organisms depends upon the method of introduction. When inoculated subcutaneously, the bacilli are found in greatest number in the neighbourhood of the inoculation site. If the injection has been made intramuscularly, they will be found numerously present in the inoculated muscles, but very frequently the subcutaneous exudate immediately in their vicinity may be very scanty in bacilli. Although this exudate may be abundant, and the causal organisms numerous in it around the site of inoculation, it is, nevertheless, difficult by the microscope to find bacilli at any considerable distance from this area, and at times in such cases even cultural methods fail to reveal them. The thoracic, peritoneal, pericardial, and intermuscular exudates (when the latter occurs some distance from the inoculation area) when present in such experimental cases are bacteria free.

Cultural Characters.—This description, as noted in the footnote on page 397, is incomplete, and relates mainly to culture in liquid media. The bacillus is an anærobe, and grows best at body temperature, but, like other anærobes,

can be grown ærobically by adopting Tarozzi's method or one of its modifications. Nissa's liver-piece broth has been found very convenient, with a slight modification as follows:—The minced liver is placed, whilst fresh, in the tubes or flasks, instead of being previously boiled. A sufficient quantity of bouillon is then added, and the tubes, &c., sterilised in the usual manner. The medium, which has coagulated into a solid mass, is broken up by means of a sterile glass rod, and, just prior to inoculation, the tubes are boiled for a short time to drive out the air which gains entrance during the storage of the tubes, the latter being cooled immediately before actual inoculation. Growth in such medium is more abundant than if the liver is cooked before it is placed in the tubes. In this medium the bacillus grows well, spores form readily, and the virulence is maintained for some months without the need for re-inoculation of cultures, provided, of course, that fresh sub-cultures are made when required for animal inoculation.

Serum broth.—Growth is abundant in this medium, and usually complete in from twenty-four to thirty hours. The growth settles at the bottom of the tube in a flocculent mass. Spores are readily formed. In plain broth the growth is very scanty. There is no gas formation.

Glucose-serum broth.—Growth is abundant, but very few spores are formed—and the culture soon dies out. Cultures in media containing glucose soon lose their virulence, and then even large amounts fail to infect. In glucose there is a little gas formation.

Liver-piece broth.—Growth in this medium is abundant, whether under oil, or exposed to the air, and is complete in twenty-four to thirty-six hours. Numerous spores are formed. The production of gas is considerable. It has a peculiar but not putrefactive odour. The medium is rendered very acid.

Milk.—Grows well. The milk commences to peptonise in twenty-four hours. There is little gas formation. In forty-eight hours the whole of the milk is peptonised, leaving a cloudy, whey-like fluid with loose clot-like deposit. The odour is most unpleasant.

Alkaline egg broth.—Growth is profuse. There is no gas formation. Spores are formed freely. A thick deposit of bacteria forms at the bottom of the tube.

Brain broth.—Grows freely, but the medium is not blackened.

Cultures in liquid media can be readily obtained by floating about half an inch of soft petroleum or liquid petroleum on the surface of the tube before sterilisation. Such, however, does not form a permanent air seal, and the tubes must, therefore, be boiled just prior to inoculation in order to drive out the infiltrated air. Olive oil was not used as an air seal, because it has been found to be quite inefficient for that purpose.

Glucose-agar stab culture.—Growth is evident in less than twenty-four hours along the needle track. No lateral branching is seen. There is a moderate amount of gas formation, and the medium is soon shattered. There is little or no spore formation, and the culture soon dies out.

Experimental.

In the previous article I dealt with the numerous inoculation experiments upon various animals, made during the investigations from 1914 to 1917, with a variety of materials taken from sheep dead from black disease, and also with bacteria isolated from different situations, some of which were pathogenic and others non-pathogenic. Of the former, it was shown that no matter how virulent the organism on par-enteral inoculation, the value of the conclusions was quite nullified unless it could be shown that the particular organism had been present in the body (in the strict sense of the term) before death. Consequently, deductions based upon experiments made with bacteria isolated from sheep "found dead," particularly anaerobes, could have very little weight.

The present account of experimental work deals with the bacillus considered by the writer to be the causal organism of black disease, isolated in pure culture from various necrotic foci in livers of sheep affected with that condition, the tissue having been removed immediately after the death of the animal To obtain such tissue, the usual procedure was followed, viz., the particular flock of sheep, usually numbering two or three thousand, in which cases of black disease were occurring, was closely watched and followed about the paddock in which they were grazing. Immediately an animal was observed sick, it was kept under closer observation for a variable period. Usually, however, as soon as it was seen to be seriously ill, it was caught, placed in a vehicle or on a horse, and taken to the spot arranged for conducting the autopsies. Here again the animal was sometimes kept under observation for a variable period, and at other times was killed at once.

During the course of the field investigations, lasting about six years, sheep have been killed in various stages of the disease. One has not always waited until they were *in extremis*; not infrequently the animal has died whilst being transported from the paddock to the post mortem shed, often a journey of only a few minutes. Yet, although the flock had been closely watched, the animal had only a short time previously been singled out from its fellows as being ill. This difficulty of picking out a sheep before it is seriously ill, from a flock of sheep kept under Australian conditions, has already been commented on by the writer.

Such specimens as were required were taken from the animal immediately it had died naturally or had been killed. Rigid precautions were taken to prevent contamination of the materials during the process. Instruments, test-tubes, specimen bottles, etc., were all previously sterilised by the autoclave in the laboratory before leaving, because in an open paddock, no matter how long one boiled instruments in the field, there might be a possibility that complete sterilisation had not been effected, owing to the vessels in which the sterilisation was conducted being exposed to dust, etc., during boiling. This rendered one's baggage both bulky and heavy, but it had the crowning merit of certainty as regards sterility of instruments, &c.

Selected portions of organs, etc., were placed in test-tubes, wide-mouthed specimen bottles, etc., with the usual precautions, and taken back to the laboratory for further work. Even after the utmost care some of the tubes or bottles were subsequently found to be contaminated, no doubt by air-borne organisms that gained entrance as the specimen was being placed in the receptacle. Any such were rejected. As a rule, with every visit to the affected localities during the season, one could always rely on obtaining sufficient uncontaminated material for subsequent experimental work in the laboratory.

In this experimental work, sheep of any age over nine months were employed. The usual sites of the inoculations were the subcutaneous tissues of the insides of the thighs, chest and neck ; also the muscles of the former. The inside of the thigh was preferred, however, on account of the ease with which one could watch the development of the lesion clinically, it being naturally devoid of wool, and capable of being manipulated post mortem with least fear of accidental contamination of the exposed tissues. With the rabbit and guinea-pig, the inoculations were made subcutaneously and intramuscularly, usually into the thigh. In the fowl and pigeon the sites were the pectoral muscles.

Young sporing cultures about twenty to twenty-four hours old were usually employed, either in serum-formate broth or liver-piece broth. The cultures from which these inoculation sub-cultures were made might, however, be some months old.

In cases autopsied immediately after death, the bacilli could be recovered in purity from the local lesion and the exudate around it. In the following notes on the experimental inoculations, it may be accepted that unless the contrary is stated, the purity of the organisms from lesions so produced was tested microscopically and culturally, and at times by inoculation into another animal. In quite a number of cases it happened that no matter what care was taken to regulate the dose of culture and the time of inoculation, the animal would be found dead upon one's arrival in the morning. In the case of sheep, although in some instances it was evident that death had not long ensued, post mortem invasion by other organisms had already taken place, so that bacteriological work on that particular animal was rendered quite nugatory on account of the character of the organisms being experimented with, although the lesions themselves were not masked by post mortem phenomena. In the case of the smaller animals, those not killed or not seen to die were discarded, and not used in the compilation of experimental data or the drawing of conclusions.

Sheep.

The administration of relatively large amounts of young, virulent, sporing cultures by the mouth has quite failed to produce any evidence of reaction, although a number of methods were employed to facilitate the action of the organism and to prevent its destruction by the digestive agencies of the animal. This is quite in conformity with the feeding experiments made with minced organs, viscera, etc., of naturally affected sheep, as previously

recorded. Subsequent inoculation experiments with sheep that had been drenched with cultures, indicate that the administration of virulent material by way of the alimentary tract confers little or no immunity.

Subcutaneous and Intramuscular Inoculation.—Small doses up to 0·25 c.c. produce in the sheep considerable local and systemic disturbance, but are not always fatal. The latter amount will frequently kill, but the result is not constant. Doses of from 0·5 to 1·5 c.c. of culture are almost invariably fatal to sheep of any age in from about twenty-eight to seventy-eight hours, usually in less than forty-eight hours. Sheep that survive experimental infection for three days often recover. With subcutaneous inoculation there is, about fifteen hours afterwards, considerable swelling around the site of injection, which gradually extends, at first mainly in a downward direction (gravitation). If the injection be into a limb, the swelling gradually reaches the coronet. As the condition progresses pronounced lameness appears, the animal often carrying the affected leg. The swollen part in the early stage of the disease is œdematous, and pits readily on pressure ; later on it becomes firmer. There is no noticeable gas formation. For a while the skin itself shows no sign of change, but about twenty-four hours after the injection a small livid spot appears at the point of entrance of the needle. The lividity gradually spreads, its actual extent appearing to depend upon how long the animal survives. If death occurs in about forty hours, it may be only about half an inch or so in diameter. If the animal lives longer, the area may extend several inches around the needle puncture. In cases where a slightly attenuated culture (artificially attenuated) has been employed, and the animal has survived, a very pronounced livid area of varying extent appears at the inoculation site, succeeded by necrosis of the overlying skin.

There is a moderate hyperthermia (about 105 deg. Fah.), with the usual clinical manifestations of profound systemic disturbance. Later, the animal becomes very quiet, and readily permits itself to be handled, or may even refuse to move. At this period, however, the mental faculties do not appear to be impaired. In the final stages the animal becomes comatose and dies very quietly.

Post Mortem Appearances.—If the autopsy has been made immediately after death, the most striking changes are observable in the inoculated area. In the case of injection into the thigh, the wool is easily pulled out of that limb. An œdematous swelling extends downwards to the coronet and upwards to the groin. At times, however, the upward extension of the swelling is absent. At others, the upward extension, instead of gradually diminishing, terminates abruptly. Possibly this is the effect of gravity on the contained exudate.

As already remarked, there is a larger or smaller area of lividity around the point of inoculation. If death has ensued soon after the injection, this area may be minute. If the animal has survived two days or so, the subcutaneous tissue in the inoculation area is considerably thickened, and shows evidence of necrosis. The subcutaneous tissues of the swollen part are saturated with an odourless exudate, which, near the inoculation site, is often

blood-tinged, but elsewhere is clear and straw-coloured. At times this exudate may be found reaching to the floor of the abdomen, and even infiltrating the inter-muscular tissues of the abdominal muscles. On a few occasions the perirenal tissue was also found saturated with this exudate. There is no evidence of gas formation.

Bacilli in purity may be ound fairly numerously around the site of inocula tion, but they are extremely scanty in the subcutaneous exudate at any distance from this area, and their presence there often can only be demon strated by cultivation. At times even this fails, especially in the case of the exudate in the abdominal floor and other such distant sites. If the injection has been made intramuscularly, the reaction is more severe, although at times the swelling of the limb is not so pronounced.

In addition to the phenomena mentioned as resulting from subcutaneous inoculation, the muscles around the inoculation site are very dark and may show a number of hæmorrhages. On incision of the affected muscles there is a distinctly unpleasant odour, but not exactly that of putrefaction. There is no evident gas formation. Parts of the muscle appear at times to have a greyish necrotic character. Others in the immediate vicinity may show a few small hæmorrhages scattered throughout their substance. The affected muscles are infiltrated with a blood-tinged, odourless exudate.

Occasionally there may be some clear exudate in the peritoneal or pleural cavities, but as a rule there is none. Almost invariably, however, the pericardium is distended with a clear, straw-coloured odourless fluid, which, like other exudates, coagulates spontaneously. It is bacteria free. If the heart, blood and organs are examined immediately after death they also are found free from bacteria. Frequently the heart shows endocardial hæmorrhages. The liver, kidneys and spleen are congested, but not enlarged. Sometimes, but not often, one may see on the surface of the former dirty, greyish-white areas of commencing necrosis, with ill-defined margins. Usually there is some more or less pronounced œdema and congestion of the mucosa of the abomasum and small intestines, but no ulceration. The lymphatic glands of the inoculated limb, and of the trunk also, are congested and swollen. There are no naked eye changes in the lungs.

Guinea-pigs.

With virulent, young cultures, doses of 0·1 c.c. injected subcutaneously are usually fatal in about twenty hours. With smaller doses of 0·02 to 0·05 c.c., the animal may live for about three days. In all cases, however, the lesions are fairly constant, viz., considerable swelling of the inoculated thigh, the skin being tense and sometimes livid. The subcutaneous tissues of the inoculated leg are saturated with a slightly turbid, odourless exudate. There is no gas formation. The subcutaneous exudation extends forward along the abdomen for some considerable distance, often as far as the axillæ. It is more abundant on the inoculated side of the body. Around the point of injection, the subcutaneous tissues show varying degrees of thickening according to the duration of the disease. The muscles in the same area have

in parts a greyish appearance of commencing necrosis, and in others a pronounced inflammatory congestion. They are not often actually hæmorrhagic. On section, if the injection has been intramuscular, the injected muscles have an unpleasant but hardly putrefactive odour. Occasionally, there may be a slight amount of exudate in the peritoneal or pleural cavities, but this is not the rule. The spleen, kidneys and liver are congested, and if the disease has lasted twenty-four hours or more there are very occasionally either ill-defined or circumscribed dirty-white areas of commencing necrosis in the latter, about an eighth of an inch in diameter. The stomach and small intestines are as a rule deeply congested, but there is no ulceration. The mucosa is œdematous, and the contents of the small intestines usually a straw-coloured, clear fluid. The pericardium is almost invariably distended with a clear, colourless exudate. As a rule the causal bacteria are confined to the neighbourhood of the site of the inoculation and the subcutaneous exudate of that region, from which they can be recovered in purity, but the further the exudate is from the local lesion, the more scanty become the bacilli.

Rabbits.

Small doses of from 0·1 to 0·2 c.c., such as would be sufficient to kill a guinea-pig are not fatal. Very frequently no reaction at all is to be seen. Larger doses, viz., 0·25 to 0·5 c.c. subcutaneously, usually result in death. In a number of instances, even with such increased amounts, death may be delayed until the fortieth hour after injection. Beyond pronounced lameness, there are few clinical symptoms to be observed until near the fatal termination.

Lesions.—There is practically no swelling round the point of inoculation, no cutaneous changes and no gas formation. The subcutaneous tissues in the inoculation area are moderately infiltrated with an exudate, slightly blood-stained near the point of injection, but colourless elsewhere. There is no odour. The superficial muscles in this region are slightly reddened, but there are no hæmorrhages. Frequently there is a considerable amount of exudate in the pericardium but no gross lesions elsewhere. The bacilli can be recovered in purity from the inoculation area, but they are not obtainable elsewhere.

The Fowl.

Doses of 0·2 c.c. of virulent culture injected intramuscularly are usually fatal, but death does not occur under about forty hours or longer. Here, again, there are few clinical signs of reaction, the bird looking apparently well until near the end. Death ensues rapidly and quietly once symptoms are manifest.

Lesions.—There are no marked cutaneous changes. The subcutaneous tissues for some distance around the point of inoculation are saturated with the usual inflammatory exudate. Near the point of entrance of the needle, it is slightly blood-tinged, but some distance away, colourless. These tissues also show evidence of necrosis. There is, however, no unusual odour and no gas. The muscles in the inoculated region and for some distance around, have a greyish-white appearance of commencing necrosis, most pronounced

along the needle track. There is no unusual odour in the incised affected muscles and no hæmorrhages. No other gross lesions have been observed save moderate congestion of the mucosa of the small intestines. The bacilli are recovered in purity from the inoculation area, but elsewhere is bacteria free.

The Pigeon.

This bird is as susceptible to artificial infection as the guinea-pig. The intramuscular injection of 0·1 c.c. of virulent culture is usually followed by death in about eighteen to twenty hours. On autopsy no cutaneous changes are evident. The subcutaneous tissues of the breast and abdomen are infiltrated with the usual exudate. There is no odour or gas formation. A distinctly necrotic line follows the needle track and extends laterally for a short distance into the muscles, the lateral extension being irregular in width. At the edges of this necrotic zone the muscles show evidence of intense inflammatory congestion, but there are no distinct hæmorrhages and no gas. On incision, the odour of the affected muscles is rather unpleasant but not distinctly putrefactive. No other gross lesions have been observed. The bacilli are confined to the lesions from which they have been recovered in purity.

Up to the present, no experimental inoculations have been made into the horse, ox or pig.

(To be continued.)

Gravenstein Grafts at Bathurst.

In the year 1914 attention was directed to a particularly fine Gravenstein apple-tree that was growing in a private orchard at Cattai. The tree had never shown any signs of twisting and had carried up to 25 bushels of fruit. A few scions and roots were obtained and sent to Bathurst Experiment Farm, where they received very careful attention, but owing to the roots having been taken from a very old tree they did not develop rapidly. The scions were grafted on to another apple-tree. The grafts on this tree did not twist, but as there were no records to show what stock this tree was grafted on to in the first instance, scions were taken from the grafted tree and worked on to a Gravenstein tree that twisted badly. The Gravenstein was cut off below where it was grafted and according to the orchardist at the farm, these later grafts are now twisting also. It seems to indicate quite plainly that twisting is simply a stock trouble, and that the scions taken from the tree from Cattai were worked on a seedling. So far, the trees that were worked on the roots are not showing any signs of twisting.—W. J. Allen.

There is nothing so good as poisoned bran for taking the hop out of a grasshopper, and there is no better way of buying and distributing the bran than through a community organisation . . . . . Fighting a grasshopper invasion without the help of the neighbours is like trying to put out a fire in a powder factory with one bucket of water.—The *Weekly News Letter* of the U.S. Department of Agriculture.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of wheat, oats, maize, sorghum, Sudan grass, potatoes, and other crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

The list is compiled after inspection of the seed and report by a field officer of the Department (preferably during the growth of the crop), and farmers who have pure high-class seed of good quality of any variety of farm crop are invited to communicate with the Under Secretary and Director, Department of Agriculture, Sydney.

The Department does not undertake to buy any of the seed.

**Sudan Grass*:—	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Temora.
	J. Cavanagh, Curlewis.
Clovers:—	
Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
Maize:—	
U.S. 133...	P. Gersbach, Farm 330, Leeton.
Golden Glow	J F Chick, Hillview, Tenterfield.
Early Yellow Dent	Manager, Experiment Farm, Glen Innes.
Silvermine	Manager, Experiment Farm, Yanco.
Funk's Yellow Dent	J. Ditzell, Lansdowne, Inverell.
	Manager, North Bangaroo Stud Farm, Canowindra.
Boone County White	J. Chittick, Kangaroo Valley.
Leaming...	Manager, Experiment Farm, Grafton.
Golden Beauty	R. Richardson, Mondrook, Tinonee, Manning River.
Manning Pride	S. Smith, Karaak Flat, via Wingham.
Golden Nugget...	J. W. Smith, Wauchope.
Manning White	A. McM. Singleton, Henley, Sydney.
Red Hogan	Principal, H. A. College, Richmond.
Craig Mitchell	W. D. K. Humphries, Muswellbrook.
Early Clarence	F. T. Dowling, Tumut.
Improved Yellow Dent ...	Manager, Experiment Farm, Grafton.
	D. J. Dorward, Fayfield, Cundletown.
Potatoes:—	
Satisfaction	O. E. Silk, Nimmitabel.
	J. D. Morse, Black Mountain.
Surprise	O. E. Silk, Nimmitabel.
Peanuts:—	
White Spanish	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm, Yanco.
Virginia Bush	Principal, H. A. College, Richmond.

In addition to those tabulated a number of crops were inspected and passed for purity, but as the growers failed to forward samples their seed has not been listed.

* With regard to Sudan grass, it should be noted that though listed above, it should not be sown until spring.

A SUBSTITUTE FOR POLLEN.

No trading is done with natural pollen (pollen stored by bees), but during a pollen shortage (when bees raid the pollard, flour or bran bins), a substitute in the shape of rye flour is fed for a limited period. Rye flour is so far the best known substitute. It is placed in small quantities daily in a number of trays that are protected from the weather and set about the apiary. Another method is to knead the flour with sugar and honey into a stiff paste, and place it over the frames or plaster it on to an empty comb.—W. A. GOODACRE, Senior Apiary Inspector.

Poultry Notes.

JULY.

JAMES HADLINGTON, Poultry Expert.

THE principal work for this month will consist in hatching and rearing, advice upon which has been given from time to time in these notes, and also in the leaflet "Rearing and Feeding Poultry," copies of which are available free on application. This being the case, I think we can afford to devote this month's space to giving readers some account of events at the Poultry Conference at Hawkesbury Agricultural College on 18th June.

THE POULTRY CONFERENCE.

The Minister for Agriculture, the Hon. W. F. Dunn, M.L.A., was present and took the chair—a circumstance which the conference much appreciated. In his opening address the Minister took the opportunity to welcome Mr. Southee, the new Principal of the College, doing so in very cordial terms. Proceeding to deal with the competition itself, he remarked that during last year, despite the strained financial position, he had provided funds for netting in the tops of the pens to prevent losses from crows, &c. It had been brought under his notice that a further desirable improvement was to provide concrete floors in the houses in the competition sections, and he had given instructions that estimates of cost were to be prepared, and as the finances improved he would give careful consideration to the question of carrying out this work.

During the year there had been much pessimism among poultry-farmers as to the large number of persons who were going out of the business, as a result of the high cost of feeding and the difficulties experienced in procuring mill offal for the morning mash. Statements had been made to the effect that a very large reduction in stock had resulted, variously stated at 20 per cent. to 40 per cent. On this point, it was satisfactory to find that notwithstanding several adverse circumstances the value of our products had increased from £2,501,000 in 1919 to £2,814,000 in June, 1920. These figures were made up as follows:

Value of Eggs ...	...	£2,169,000
Table Poultry ...	...	645,000
Total...	...	£2,814,000

According to figures made available by the Government Statistician, the present poultry flocks of New South Wales were double those of 1913, so that the industry was in a most satisfactory position compared with other parts of the world. As a case in point it might be mentioned that in 1919, five years after the war began, which should furnish a safe basis on which to make comparisons, the imports to the United Kingdom had dropped 90 per cent. in the case of eggs, and over 80 per cent. in table poultry.

Reverting to the local position on 1st January, 1920, the approximate number of poultry in the State was 7,835,000, though the seasonal sales of table poultry had, of course, reduced the number to 3,168,000 in June of that year. This was a reduction of 500,000 head on the number carried at the corresponding period of 1919, or, in other words, a loss of 17 per cent The figures for 31st December last were not yet available, but the indications were that there were then approximately 7,500,000 birds on our farms, so that the position then was even better than was generally anticipated. The loss of 17 per cent. was serious enough, but, all things considered, it was satisfactory in view of the difficult period through which the industry had passed. Fortunately the high cost of feed had been more than counter-balanced by the rise in price of eggs, and this was borne out by the fact that notwithstanding the reduced number of producing hens, there was an increase of £313,000 in the value of poultry products for the year ended 30th June last.

Much had been said about the high price of eggs during the autumn and early winter months, and undoubtedly when eggs cost above 3s. per dozen, instead of being within reach of all classes of consumers as an every-day article of nourishing food, they became a luxury available only to a limited number in the community. The remedy seemed to be to cheapen production, and this appeared to depend on (1) cheaper food, (2) an increase in the existing flocks, or the building up of new ones, and (3) improving the quality of the stock. He had given directions that the resources of the Department were to be directed towards these objectives, and that all possible assistance was to be given the poultry-farmer in these directions.

The dominant factor in the food question was, of course, the prevailing high price of the staple foods. As a member of the Central Wheat Board, it was a delicate task for him to discuss the price of wheat and its by-products at a gathering of poultry-farmers, but they could rest assured that when the price of wheat was being fixed every effort was made to supply it to poultry farmers at as low a figure as possible. Many interests had to be considered, and those of the poultry-farmers were certainly not lost sight of. In addition, the Government, through the Meat Industry Board, had lately decided on the manufacture of lucerne meal, which was to be undertaken on an extensive scale, and would be supplied at a price carrying only the barest margin of profit. The results could not fail to be of the greatest benefit to the industry. In addition, he had caused a Foods Investigation Committee to be formed in the Department of Agriculture with a view to utilising any product that was likely to be of use as a poultry food. This committee had done valuable work, and was carrying out an important series of feeding experiments. One experiment would cover the feeding of different percentages of lucerne and other meals in addition to bran and pollard. Another test would embrace the feeding of cereals in conjunction with liver grains. It should be clearly understood, however, that the object of these experiments was not to displace bran and pollard from the daily ration, as for many reasons that was an impossibility, but to collect information about all the useful and cheap supplementary foods.

Contributed Papers.

Mr. G. W. Lavender read a paper in which he pointed to the deterioration of certain old breeds, and advocated the resuscitation of several that were being neglected.

Mr. W. H. Paine, Manager of the Animal Foods Department of the Metropolitan Meat Industry Board, reviewed the food supply of the industry, particularly in regard to bran and pollard, and dealt with certain substitutes that would possibly become useful, laying special emphasis on lucerne meal.

Some Observations on the Industry.

In the course of some observations on the poultry industry, the Poultry Expert remarked that the position in 1920 was interesting from the fact that according to figures, the poultry-farmer should have been in a much more prosperous condition in that year than in any previous one during the currency of the competitions. This had been attested by some poultry-farmers in a general way, but unfortunately it was difficult to get reliable data as a basis from which to estimate the probable returns from a well-run commercial poultry-farm. In using competition figures he wished to make it clear that these were not presented as possible commercial results. Rather it should be understood that, however they might lament the fact that many of the birds penned were not up to competition standard, they were nevertheless of a higher general average as layers than the birds on any commercial farm, because ninety competitors had all done their best to put in the best of their available stock at the time of penning.

If they compared the cost of feeding with the returns they would find that the cost per hen, in 1919, was 9s. 3d., while the gross return per hen was £1 8s. 4½d. In 1920 the cost of feeding rose to 12s. 8d., while the production amounted to £1 17s. 11d.—a difference of 6s. 2½d. per hen in favour of 1920, and yet there had been a decline of 17 per cent. in the number of birds kept.

At the 1919 Conference he had presented an estimate of the returns over cost of feeding on a 12-dozen basis. The return then was 9s 8d. per hen. He had further pointed out that the figures over the whole of the sixteen years showed that the high cost of food had been consistently followed by a higher price for poultry-farmers' products. On the same basis—12-dozen birds—and with the average price of eggs 1s. 10d., the return over cost of food in 1919-20 was 12s. 9d. The cost of feeding for the competition year ending 31st March, 1920-21, had risen to 12s. 8d. per hen, while the return over cost of food on the same 12-dozen basis, with an average price of eggs 2s. 2d. per dozen, worked out at 18s. per hen. It should be remembered that the falling off in numbers had been due, not so much to the operations of 1920 as to the conditions that had prevailed in the previous year. Therefore, the crushing out process was not so much due to the effects of the troubles of 1920 as those of 1919, and probably less to the prices of foodstuffs than to the difficulties attendant upon obtaining them. The changing from one food to another had also, no doubt, the effect of lowering production.

The outcome of all this was that, notwithstanding increased value, there had been a decrease in the volume of production, and the higher value received for poultry products in 1920 was due principally to that circumstance.

In connection with the proposed feeding experiments, there appeared to be a notion abroad that the poultry-farmer must get away from the use of pollard and bran, and find substitutes for those articles. It might be as well to disabuse their minds of all such notions. He did not expect, nor did investigations support any such departure. If, for instance, they could imagine a food situation that would admit of the cutting out of mill offals, the effect would at once be the creation of another situation that would force upon them the use of them again, because they would become cheaper than other articles. So far as could be seen, the most they could hope to accomplish with cheap foods was to supplement the pollard and bran ration for the morning mash And this had been forced upon them by the fact that the industry had apparently outgrown its food supply. Substitute articles of food would avail nothing if they were higher in price. They must keep down the cost of production, and that did not appear possible if they used foods at a higher price than those ordinarily used, such as wheat, bran, pollard, and maize. They had before them many years' results of feeding on the foods mentioned, and had also definite figures in the annual returns of the competitions. It was no part of the Department's policy to experiment with foods more expensive than bran and pollard.

The Raw Material of Nicotine Solutions.

In consequence of an inquiry from an orchardist in the Bathurst district, early in the present year, the Department of Agriculture addressed the United States Department of Agriculture at Washington, asking whether ordinary tobacco is used for the manufacture of "black leaf 40," or whether a special tobacco is grown for the purpose.

The reply of the Insecticide and Fungicide Board, Washington, was to the effect that it was understood that all nicotine solutions made in the United States were manufactured from tobacco stems and tobacco refuse, or from waste tobacco not suitable for the manufacture of cigars, chewing or smoking tobacco. According to the Board's information, no tobacco was grown in the States essentially for the production of nicotine.

The Scientific Name of Kikuyu Grass.

In the *Journal of Department of Agriculture*, Union of South Africa, March, 1921, page 211, appears the following:—

> We received last mail an answer to a letter addressed to Mr. Stapf on the subject of Kikuyu grass, which appeared to have been wrongly named at Kew. I wrote suggesting that the grass was *Pennisetum inclusum* Pilger. Mr. Stapf replied that after examination of the material of Kikuyu and of related species, he had established the fact that Kikuyu grass was not *Pennisetum longistylum* as he had previously supposed, but was *Pennisetum inclusum* Pilger; however, as the grass had previously been described under the name of *Pennisetum clandestinum*, Kikuyu grass must henceforth be known scientifically under that very appropriate name.

—E. Breakwell, Agrostologist.

Orchard Notes.

July.

W. J. ALLEN and W. LE GAY BRERETON.

Pruning will still be one of the main operations to occupy the attention of growers of deciduous fruit. Where this work is completed on the stone fruits, attention can bo turned to the pear and apple trees. Usually by the end of June most of these trees have lost their leaves, but owing to the unseasonably mild weather this season they have been very slow in dropping them and the work of pruning will be slower, as it is difficult to observe quickly in detail the condition of the tree.

Some general notes were given last month on pruning, but those not too conversant with this work should procure the Department's book on the subject. It is a good plan to take a few trees of each of your main varieties and prune them in detail with some variation, then watch the results during the next season. In this way you will find that the trees are the best teachers as to the way to handle them under the particular conditions under which they are growing.

Attention may be directed to the article on the pruning of the Rome Beauty apple in the June number of the *Agricultural Gazette*. Any scions that are required for the coming grafting season should be secured while pruning is going on, and buried in moist sand in a cool, shady spot. Care should be taken to obtain scions only from trees that have proved heavy croppers of a good type of fruit

Spraying.

With the exception of the very early blossomers, such as Edward VII, Bell's November, &c., an effort should be made to spray all peach and nectarine trees with freshly-made lime sulphur at full winter strength, or with Bordeaux mixture at winter strength, to control an outbreak of leaf curl.

Lime-sulphur is preferable to Bordeaux mixture under most circumstances, as it also helps to check San Jose scale, but winter strength lime-sulphur, applied later when the buds are just ready to burst, gives a better result over San Jose scale than an application while the trees are dormant, and where this scale is present a second application should be made at the later period. Apples, pears, plums, cherries, and apricots do not require an early application for leaf curl, and it is better, therefore, to delay the application of winter strength lime-sulphur for scale insects until the buds are just about to burst. As a matter of fact, in many tests the Department has applied winter strength lime-sulphur to deciduous fruit trees when the blossom buds are showing colour without any injury to the tree or to the setting of fruit. The effect is to give more opportunity for the scale to be also on the move, when it is less resistant to the spray, but owing to the erratic behaviour of sprays, though

one might feel justified in risking the application at this period himself, it is hardly safe to recommend it generally. Moreover, when one has to cover a large area, which taxes his spray outfit to its limit, and there is also danger of delays through bad weather, &c., it is a safer plan to start when the buds are well swollen, thus giving a longer period to get the work through. In all cases it pays to be thorough with the work, bringing the spray nozzles well out beyond the tips of laterals and leaders. These are the parts which are most easily missed, and to which the spray adheres less readily than the thicker wood of the tree.

Where San Jose scale is bad in an orchard or on any particular trees, miscible oil often gives a more thorough kill than lime-sulphur. The oil sprays are also useful on apple trees where woolly aphis is present.

Where mussel scale has to be contended with, the miscible oil should be used stronger than for San Jose.

Ploughing.

Last month the necessity was pointed out of getting the winter ploughing done by July, except where an autumn ploughing had been carried out and the ground had not again become set or had made a lot of weed growth.

In most districts there have been repeated falls of rain which have not only soaked the soil and subsoil, but have also caused much delay in winter operations. Under these conditions orchardists would be glad to see the ground dry up sufficiently to get on with their work, and one often feels that the land will never dry out again too much before the summer. Yet we would again impress upon the grower to push on with his ploughing as soon as the land is fit. There is no saying whether the spring may turn out dry, and after abnormal falls of rain the land becomes very compacted and seems to dry out surprisingly quickly.

Where farmyard manure or slow-acting fertilisers are being used they should be spread and turned under at this ploughing.

Planting.

Except for those deciduous trees that start early, planting can be continued this month provided the land is in good condition.

WORK ON THE MURRUMBIDGEE IRRIGATION AREAS.

LIME-SULPHUR applications at winter strength should be made on all varieties of peaches as early as possible as a safeguard against peach curl. Hitherto Pullar's Cling has not shown the effects of the disease to any extent, but last season quite a number of trees bore evidences of it.

It will be well also to spray apricots with lime-sulphur for shot-hole; many blocks were affected with this last season.

Red mite was also bad last season: when lime-sulphur was used it did not have the desired effect on some blocks of prunes, and no doubt miscible oils would give better results.

Where it is not necessary to use miscible oils, it is wise to treat all deciduous trees with lime-sulphur at full strength during the winter.

The swabbing of vines should also receive attention: growers should use the 10 per cent. solution of sulphuric acid.

Pruning.

The pruning of peaches, apricots, plums, and prunes should be pushed on with, and vines, pears, and apples should follow. In pruning the Pullar's Cling peach it would be well to consider its habit. It is sometimes necessary to leave two-year-old laterals which are carrying yearling laterals or spurs, where there are not sufficient of the previous year's primary laterals.

Winter Ploughing.

Winter ploughing should be well in hand now, and the work should be done so that the open furrow will be left in the centre of the rows and act as a drain to carry the winter rains off the land. Winter ploughing should be from 7 to 9 inches deep where possible, the soil and main roots of the tree being considered. Many orchards on the area are ploughed shallow at all times, and the work should generally be deeper.

Planting.

The planting of all deciduous trees and vines should be started this month. See that all damaged roots are cut back to sound wood, and that before growth starts all top growth is headed back hard. Grape vines should be cut back to two eyes when planted. The planting of citrus trees should be postponed till later—preferably until August or the early part of September.

It was noted on some blocks last season, that where Robe de Sergeant and Prune d'Agen were planted side by side, the "Robe" trees nearest the "d'Agens" cropped best. It might be well to consider the arrangement of the trees in the orchard from the point of view of cross-fertilisation. Prune d'Agen is evidently suitable for the purpose in connection with "Robe."

Harvesting.

Early harvesting of Thompson's Improved Navel and Navelencia is wise, owing to their tendency to dry out. In harvesting the citrus crop it might be well to place consignments regularly on the market as soon as they are well coloured, rather than to wait until late in the season and then to place heavy shipments for disposal at a time when coastal supplies are likely to cause a glut.

APIARISTS should possess a good knowledge of the honey-producing flora in their respective districts, as very often a flow of inferior honey will follow close on a flow of good honey, and unless the flows are kept separate serious loss may result. A small percentage of dark honey often spoils a crop of superior grade honey. Some prominent western beekeepers have had this experience this season.—H. GRAHAM SMITH, Instructor in Apiculture, Hawkesbury Agricultural College.

Agricultural Bureau of New South Wales.

DISTRICT CONFERENCE AT INVERELL.

A District Conference of the Agricultural Bureau, the second in this State, was held at Inverell on 30th April. The Conference was convened at the suggestion of the Tingha branch, and a number of important and interesting rural questions were discussed. Mr. J. Ditzell (Chairman, Inverell branch) occupied the chair, and other delegates present were Messrs. G. W. Browning, William Vickery, A. M. C. Levett, John Hawkins, and Rev. J. T. Redhead (Tingha branch); J. W. Dawson and T. J. Gray (Elsmore branch); and F. A. Lewin, W. A. Kook, C. Lenthal, A. S. Pigott, R. L. Campbell, A. Fowler and J. Leech (Inverell). Mr. C. C. Crane, Organising Inspector, was also present, and Mr. J. T. Dale (Secretary, Inverell Chamber of Commerce) attended for a portion of the time.

Among the resolutions passed were the following:—

That the most effective method of reducing the cost of living is the encouragement of co-operation, and that the Department be asked to assist the movement by furnishing branches with information *re* successful systems in Denmark, England, U.S.A., &c.

That the proposed pruning competition is worthy of the support of the district branches, and that the Department be asked to place such competitions on a proper footing by issuing certificates of competency to the successful competitors

That the Department be asked to assist branches in interesting children in rural life by the formation of clubs on similar lines to the cotton, corn, and canning clubs in U.S.A.

That encouragement be given local industries by: (*a*) Experimenting in the culture of various plants, such as linseed, cotton, sugar beet, tobacco, or any other known plant likely to start local industries; (*b*) approaching the Government with a view to having the preferential rate system altered, so that it will assist, instead of retard, local industries; (*c*) making inquiries, both here and abroad, either through the Government or direct, regarding all such industries.

That as Inverell is the most important centre in the north, the Government be approached with a view of having an experimental farm established handy to the town.

That as the import duty now imposed on all classes of agricultural machinery threatens to paralyse the whole of the primary industries, the Federal Government be asked to revoke same in order to stimulate rather than to retard production.

That in order to assist the P. and A. Society, the conference devise a scheme of putting in an exhibit of farm produce in trophy form in the 1922 Show.

That in order to stimulate land settlement, and remove stagnation, the Government be asked to adopt a more vigorous policy regarding railway construction in country districts, and that our members be asked to bring the matter of connection by rail with the northern system immediately before the Government.

That as the present high freights on manures, seeds, and machinery threaten to materially lessen production, the Government be asked to reduce same by at least 50 per cent. up to 300 miles, and 75 per cent. over 300, in order to increase settlement and assist in decentralisation.

REPORTS AND NOTICES FROM BRANCHES.

NOTE.—While gladly publishing in these columns the views of members of the various Branches of the Agricultural Bureau, the Department does not necessarily endorse the opinions expressed.

Adamstown.

The ladies' branch at this centre met on 26th April, when an interesting discussion took place on the pruning of roses and the culture of Cape gooseberries, Messrs. Brock and Lewis (of the gentlemen's branch) attending and affording interesting information.

Auburn.

The first annual meeting was held on 14th May, when the business was transacted amid a social atmosphere created by a pleasingly arranged room, a programme of song, music and story, a collection of fine specimens of flowers and vegetables, and light refreshments.

The report showed a year's useful work, and the balance-sheet a credit of £5 19s. The election of officers resulted thus:—Chairman, Mr. F. J. Burrows; Vice-chairmen, Messrs. W. H. Petch and J. Bailey; Treasurer, Miss Dole; Hon. Secretary, Mr. J. J. Pratt; Assistant Secretary, Mr. A. Baxter; Auditors, Messrs. Murdoch and Jones; Steward, Mr. Metcalfe; Monthly Exhibition Judge, Mr. G. Somerville.

A trophy (a fountain-pen) was presented to Mr. A. Curr, who introduced most new members to the branch during the year.

The prizes won by the competitors in the monthly exhibitions were presented by the Chairman. The aggregate prize was won by Mr. Westcott.

The branch met again on 11th June, when Mr. C. Bennett, of Wentworthville, delivered a lecture on the electric culture of plants. Photographs of the results obtained by Mr. Bennett in his own garden were exhibited and greatly impressed all present. The lecture was regarded as one of the most interesting yet given in connection with the branch.

Bimbaya.

This branch met on 24th May, when preliminary arrangements were made *re* crops to be grown for an exhibit at the next Candelo show.

It was agreed to inaugurate a maize-growing competition, open to boys and girls under eighteen years of age, but confined to the children of members of the Bureau. Prizes will also be given for the best collection of jams, jellies, and preserves made by girls under eighteen years.

The branch is taking an interest in the establishment of a branch of the Rural Bank at Bega.

Blacktown.

This branch staged a district exhibit at the Hawkesbury show on 12th May, and scored 472 points, which won it second prize. Heavy rain prevented a considerable quantity of produce being forwarded, but the exhibit was nevertheless a very creditable one. Quite a number of members assisted in the organisation and the staging of the exhibit.

At a meeting on 28th May, the chairman and secretary reported having attended a conference at Parramatta with regard to the establishment of municipal markets in that town. The secretary, Mr. Lalor, also reported attending a conference of delegates of various branches of the Bureau at Wentworthville, when a co-operation of branches was formed under the title "Cumberland Agricultural Bureau United," to assist branches in holding exhibitions, &c. Arrangements were made for the continuance of the delegates in their work.

A citron melon, weighing 84 lb., was forwarded by the secretary of the Lower Portland Branch, and accepted with thanks. An excellent sample of peanuts was exhibited by Mr. Clifton, and this promoted some discussion on peanut culture. Mr. W. McCullough stated that he grew 140 peanuts on one plant at Prospect. Mr. Lalor remarked that he cut forty canes, each 10 feet long, from a single root of elephant grass at Seven Hills; and Mr. Clifton reported a sweet potato (white), weighing 13¼ lb.

The treasurer reported that the credit balance at date was £12 12s

Castle Hill.

At a meeting on 18th May an instructive address on vegetable-growing generally was given by Mr. H. Rumsey, to an appreciative meeting. The importance of good drainage and cultivation was emphasised, and the fact that good results could not be obtained without both was clearly indicated. To observance of these two things Mr. Rumsey attributed his own success, for he began vegetable-growing without any previous experience.

Clifton (near Young).

This branch held a meeting on 3rd May, when, in addition to general business, a lecture was given by Mr. Wyndham on bees.

The lecturer began with a very interesting description of the bee's anatomy, and then went on to say that the best site for an apiary was an eastern slope, well protected from winds, and as near to a forest or to many trees as possible; above all, it should be above flood-level. The beginner should start with only two or three hives, and should read up the subject of bee-keeping as well, increasing the number of his hives as he gained experience. The laws regarding frame hives must be observed, and in any case they are a great advantage. They did away with all difficulty in examining the hive for signs of disease, and also enabled the honey to be extracted more easily and without waste of comb. The various kinds of bees in the hive, and the internal economy of a colony were described; and finally diseases were briefly dealt with.

Cooper's Shoot–Broken Head.

A meeting was held on 21st May, when a discussion took place on the rice bean and its utility as a green manuring crop on banana plantations, and several members decided to give it a trial in the coming spring.

Gerringong.

The monthly meeting was held on 24th May, when a paper on maize-growing was read by Mr. C. T. Hindmarsh. The following paragraphs are extracted from the paper:—

Maize-growing.

Maize needs a rich soil, and does exceedingly well on the flat land of this locality; yet on the hills very profitable crops can be obtained if the season is suitable. The ground should be ploughed up in the winter, broken down fairly well, and left in this condition until rain falls; then, when the ground is dry enough, it should be disced to conserve the moisture. If the ground is reploughed just before planting, harrowed and rolled, it ought to be in good condition for planting.

The time for planting varies from September to December according to the season. If the early varieties, such as U.S.133 and Silver King, are sown, say, at the end of September, two crops can be gathered in the season, as they mature in eighty to ninety days.

Planting is done most expeditiously by a machine with a five-hole thick plate and a 13 sprocket. This gives four or five grains in a hole, and about 3½ feet apart in the drills. A ten-hole thin plate can be used with a six sprocket; this gives a grain every 10 inches. I prefer planting drills 3 feet 6 inches apart, as the crop can then be conveniently worked with the ordinary scuffler. I have found using two horses and sighting pegs to be the most satisfactory way of using the machine. With one horse, the driver cannot see ahead, and to see the marker he must pull the machine to one side.

If a machine is not available, the next best method is to drill with a furrow plough 3 or 4 inches deep, and drop the seed by hand three or four seeds every 3 feet, or separate seeds every foot, and then harrow in. With this method I have found that it is not advisable to leave the furrows open too long, as the moisture lost by so doing will make a big difference in the way the seed will germinate.

The advantages of the machine are that the seed and manure are both put down at the right depth and then covered in at the same operation.

I have found that 2 cwt. per acre of superphosphate gives very satisfactory results, though these can be improved on by the addition of bone-dust.

When the plants are 12 to 18 inches high in normal soil, the roots will have extended 1 to 2 feet from the plants in a lateral direction, and as the plant grows they gradually approach to within 3 or 4 inches from the surface. This goes to prove the necessity for shallow cultivation, as stirring the soil too deeply will be detrimental to the yield. The shallow-rooting habit of maize also calls for great care in hilling with the plough, where that is considered necessary.

Hilling maize is a practice that I do not recommend, as from my own experience there is nothing gained by it, and the ridges left make the following ploughing very awkward.

The first stage of growth, three to four weeks, sees the whole of the plant constructed in embryonic form; all the nodes, leaves, and rudimentary ears are present at the end of this period. Even the number of rudimentary grains on the ear are all present and cannot be increased thereafter, and the next stage of two or three months is confined to the elongation and increase in size of the parts already formed. During the third stage, the internal elaboration of the plant-food already taken up takes place, and the starch is transferred from the leaves to the ear—that is, the grain is developed. This explains the need of a well prepared seed-bed, and the conservation of moisture.

The selection of seed maize is best carried out in the field by taking the cobs on the best producing stalks, such as those which produce two well filled cobs. Cobs should be selected that are well protected by the husk at the top.

After selecting in the field, I also go over the cobs again in the barn for uniformity, to see that they are well filled on the butt and tip of the cob, and that the rows are not too widely spaced, and that the number of rows on the cob is correct.

Experiments have proved that the operation of suckering maize does not warrant the expense, and I would only advise suckering when there was a shortage of green fodder for stock, as in times of a dry spell, when one did not want to sacrifice the crop of maize.

Experiments carried out in 1903 at Hawkesbury Agricultural College also proved that de-tasselling, or taking off the upper portion of the stalk after the cob had set, resulted in a loss of 5 bushel per acre in the yield.

Carbon bisulphide is one of the most effective fumigants for maize intended for seed. If the fumigation is to be successful the seed must be treated in an air-tight receptacle and fumigated for twenty-four hours. After that time the seed must be spread out in the air to get rid of the fumes, which, if allowed to remain in contact with the seed for any length of time will injure its germinating power.

At ordinary temperatures 1 oz., or two large tablespoonfuls, is sufficient for 3 bushels of shelled grain. Carbon bisulphide is heavier than air, and the liquid should be placed in shallow vessels or poured on to cotton waste on top of the seed to be treated. This fumigation does not affect the grain as food for stock.

In the variety trial, which I have just completed (with the exception of ascertaining the weights per acre) in connection with the Department of Agriculture, thirteen varieties were sown on 14th October, 1920. At the time of sowing, the ground was in good condition, having been worked since the winter crop of sorghum had been taken off, but it was a little on the dry side for a good germination. Fortunately two thunderstorms resulted in 84 points of rain, which caused a very good germination. All varieties were well up by the 27th October, and only a few grains of one variety had to be re-sown, and these may have been missed by the drill.

U.S. 133 and Silver King tasselled early in December, Funk's Yellow Dent the fourth week in December, and the other varieties were not far behind. At this period 97 points of rain fell, helping considerably the fertilisation of the grain. U.S. 133 and Silver King were ready for harvesting at the end of February.

The interest of the lecture was enhanced by the exhibition of cobs of all the varieties grown in the trial.

Glenfield.

A useful paper was read by Mr. W. Magee on wool and wool-classing at a meeting on 17th May.

Glenorie.

At a meeting on 28th May a discussion took place on pruning, and arrangements were made for an early pruning demonstration.

Kellyville.

A well-attended meeting was held on 9th May, when ordinary business was transacted.

Kunama.

A branch of the Bureau has been formed at this centre, the first secretary being Mr. T. G. Braithwaite. A meeting was held on 19th May, when general business was transacted, and a lecture was given by Mr. Siefleet.

March.

The members met on 18th May, when a paper on co-operation was read, and provoked some discussion.

A packing demonstration was given by Mr. H. Broadfoot, Fruit Inspector, at Mr. H. V. Howarth's orchard on 8th June, and was found most instructive by those who attended.

Matcham.

A meeting took place on 21st May, when arrangements were discussed for the Matcham Village Exhibit at the next Gosford show.

Middle Dural.

This branch met on 19th May, when several matters connected with its general usefulness were discussed, and delegates to the Fruit-growers' Association's Conference were appointed.

Milton.

This branch has been considering the purchase of one or more bulls of good breeding, with a view to their use by members for approved cows. Two meetings were held during May on the subject, but unfortunately both were wet nights, and the matter had to await a meeting on 14th June, when it was decided to purchase two bulls (one each Shorthorn and Jersey.)

Mittagong.

Mr. Hill, Fruit Inspector, was present on 16th April at the Farm Homes for the purpose of giving a pruning demonstration, but as the ground was wet and it was raining heavily, the intention could not be proceeded with. However, Mr. Hill made good use of the time by giving a lecture, which was much appreciated by hearers. The varieties to grow, the methods of pruning, and the methods of packing were all usefully touched on. The lecture was held in the packing-house at No. 8 Farm Home, so that material was at hand for practical demonstration.

Moss Vale.

On 16th May Mr. A. E. Hamilton, Inspector of Stock, lectured before this branch on matters of general interest to stockowners.

The important part that the minute organisms commonly called germs play in everyday life was explained, and the various diseases that they cause were mentioned; many interesting lantern illustrations of the various germs were projected on to the screen. Anthrax, tuberculosis, swine fever, and strangles were specially dealt with; and the ways in which they and other diseases might be combated and treated, and also prevented, were pointed out. A series of slides illustrating ringbone, spavin, splints, &c., was also shown, notably one showing the growth of bone over the rope of a halter left on a horse when he was turned out.

Mount George.

A branch has been formed at this centre that has every prospect of a useful existence. The following are the office-bearers:—Chairman, Mr. H. J. Bakewell; Vice-chairmen, Messrs. J. H. Cameron and R. D. Andrews; Treasurer, Mr. T. H. Hodgins; Hon. Secretary, Mr. A. W. Andrews.

On 21st April, Mr. Max Henry, M.R.C.V.S., visited this district and delivered a lecture on mammitis, which was greatly appreciated by all hearers. The symptoms and causes of the condition were clearly described, and the means that might be adopted to avoid it were indicated in a useful way. He urged all dairymen to fatten affected cows (except tubercular ones), and dispose of them to the butcher, as the disease did not extend beyond the udder. The question was asked whether the milk from an affected cow was fit for consumption provided it was boiled, and the answer was in the affirmative. Whether a cow that lost one-quarter would give her full normal yield was also asked, but the answer was a negative.

Mr. A. A. Ramsay, Principal Assistant Chemist, delivered a lecture before the members on 19th May, his subject being manures and their use on the farm.

Oberon.

On 19th May members of this branch met and made arrangements for a display during "Country Week" in Sydney of potatoes grown in the district, and also for a trophy of products on the occasion of the turning of the first sod of the Tarana-Oberon Railway.

A potato competition was held, five exhibitors producing twelve potatoes, each of the Early Rose variety. Mr. D. Eaton acted as judge, and awarded first place to Mr. G. N. Falls and second to Mr. W. Franklin.

A paper was read by Mr. A. Buckley on fruit-growing, especially the control of black spot.

A Grower's Experience with Pests and Diseases.

Mr. Buckley said he had started some years ago to make a living by fruit-growing on a small piece of light sandy land. After a while he realised that disease was rampant in his orchard, and that something would have to be done. He had conducted various experiments with different formulæ for control of insects and fungi, and had made various discoveries of his own. San José scale he soon found could be controlled with lime-sulphur in the spring. Woolly aphis required a high pressure spray, and though his trees were supposed to be on Northern Spy stock, he doubted if they were. Codlin moth could easily be controlled with the three sprayings with arsenate of lead as recommended by the Department. For leaf-curl he used lime-sulphur or Bordeaux mixture. With black spot he had more trouble, and had had variable results with different sprays, but had latterly been better satisfied with lime-sulphur. The prevalence of this disease depended on the weather, but spraying prevented it from spreading and the spots also died out. On one occasion he had had a good crop set on Fanny and Cleopatra, but owing to black spot had only harvested half a crop. The next year he used lime-sulphur, and from forty-six trees had sold 300 bushels.

His method of cultivation was to plough once in the winter and again late in the spring. He preferred low-headed trees, as though more work was involved in their cultivation there was less trouble in picking, while the sunlight got into the trees better. There seemed always to be more black spot on the south side of the tree. Early pruning caused more growth than late pruning, according to his experience.

On 4th June members met again and discussed a proposal to send a delegate to the North Coast to arrange for the sale of seed potatoes direct to the growers there. It was agreed eventually to communicate with other branches of the Bureau, through the Organising Officer, Mr. C. C. Crane, inquiring the possibility of direct transactions with North Coast growers.

Pambula.

A meeting took place on 6th May, when the success that seemed to be attending co-operative buying in other centres was discussed, and it was agreed to obtain particulars of the methods adopted there.

Preliminary arrangements were made for staging a district exhibit at the next local show, and an effort is to be made to ensure a thoroughly representative collection, including the local timbers for which the district is well known.

The importation of parcels of seeds containing weeds and foreign matter was the subject of condemnation, and it was considered that greater supervision and control should be exercised in the matter.

Penrose-Kareels.

The monthly meeting was held on 16th May, when the balance-sheet for the exhibit at the Royal Agricultural Show, Sydney, was presented, showing a credit of £3 8s. 7d. A considerable part of the evening was spent discussing the possibilities of a co-operative movement in connection with the branch.

Springside.

At a meeting on 24th May, Mr. W. R. Birks, Inspector of Agriculture, delivered a lecture, a summary of which will appear next month.

Sydney (Metropolitan).

An illustrated lecture on the Murrumbidgee Irrigation Areas was given by Mr. D. J. Quinn, at a meeting of this branch on 23rd May. Glowing pictures of the progress and possibilities of the great scheme were painted, a feature being a comprehensive display of exhibits representing every form of produce grown on the area. A fine series of slides illustrating the development of the work from its inception to the present stage, with 1,300 homesteads, incorporating 70,000 acres, was also screened.

Lecturettes were also given by Mr. A. H. E. McDonald, Chief Inspector of Agriculture, Professor Watt and Professor Douglas Stewart, of Sydney University.

The attendance was large, and there was evidence of a quickening interest in agricultural matters. Mr. A. A. Hamilton has been elected Hon. Secretary of the branch.

Tahmoor.

A meeting of the branch was held on 14th May, when Mr. A. Crane read a paper on the marketing of fruit, and provoked a useful discussion.

Tennyson-Kurrajong.

A meeting was held on 2nd May, when Mr. H. C. Pain lectured on common diseases of stock, and interested his hearers.

Thyra-Bunaloo.

The best depth to sow wheat in dry and moist soils respectively was the subject of discussion on 21st May.

Mr. W. Glenn favoured sowing as shallow as possible, provided the grain was covered; in any case, no deeper than 1 inch. Wheat had a great capacity for sprouting again, providing mould did not make its appearance, shooting at least three times and growing.

Mr. Berryman said that with pickled and manured wheat the risk of mould was greater than with unpickled wheat when sowing in a doubtful seed-bed.

Mr. Tomlinson found that after rain the greatest danger from mould was when several frosts had set the ground just as the grain was shooting, thus excluding the air. If the surface was at all set, especially in frosty weather, it was always a payable proposition to break the surface with the harrows.

Tingha.

At the April meeting a paper was read by Mr. D. McNab, portions of which are extracted as follows:—

Surveying as Applicable to the Man on the Land.

The landholder frequently requires to know the areas of certain portions of ground to a fairly accurate degree, but without having to employ a surveyor, as, for instance, the area of a partof a paddock that has been ringbarked, or scrubbed, or the area of a ploughed paddock. He may require the actual cubic contents of an excavated tank or dam, or he may want to cut a water-race to fill the dam at a certain grade. By the correct use of the "surveyor's chain," as it is usually called, together with a plumb-bob, most of these can be obtained accurately.

The first essential point to be remembered is that all measurements must be reduced to the horizontal, and consequently all areas are measured as if they were all on the one level plane. The old surveyors' chain consisted of 100-link pieces with swivel joints, and about 400 wiring parts, which meant that after a while a chain of this type became inaccurate. The more modern type is a plain steel band with one or two swivel joints, marked off into links with brass studs, of which every tenth link has a distinctive mark and with a width of about half an inch. In addition a steel-band chain varying in width from one-sixteenth to one-eighth inch and from 5 chains to 3 chains long is used, with the end of it for about 50 links marked in 10 links, and the end 10 links at every link, and also marked at every chain. These chains are light, strong, and accurate, and are made without any projecting parts to catch when being pulled through the scrub. For a plumb-bob, a suitable weight, such as a three-quarter inch nut, attached to a fine string suits admirably.

To chain a line two men are required, who must keep in a straight line. It is best then to line off the lines with pickets before chaining. The pickets can be set in line by sighting with the plumb-bob, selecting straight sticks and sharpening them at each end, and setting them in the ground as far apart as they can be conveniently seen. A small piece of paper fixed to the top of a picket enables it to be distinguished from surrounding scrub.

Work is facilitated by marking off the whole of the lines to be chained, as the number of marked lines is then known. This leads us to the question of how many lines are required to enable the area to be found. In many cases four lines are sufficient in marking off the perimeter or outside, but these four lines are not enough to determine the area unless the four-sided block be rectangular in shape. An additional line must be measured between a pair of opposite angles if the four-sided figure is not a rectangle. For every additional outside line required to mark off the area an additional diagonal must be measured. Thus a four-sided figure is measured by the sum of areas of two triangles thus formed, a five-sided figure by three triangles, and, in general, the number of triangles in the subdivision is two less than that of the outside lines. In many cases, however, the area can be marked off in the form of a rectangle or four-sided figure with the angles 90 degrees or right angles, in which case the opposite sides are of equal length. The area is then got by multiplying the length by the breadth.

To mark off a right angle a very handy instrument is the optical square, but a right angle can be measured off by means of the chain alone. First measure off 30 links on the fixed side and put in a peg. Then measure off 40 links, and mark off a curve by sweeping round an arc at the end of the 40 links. Then from the second peg on the line lay off 50 links in a curve to cut the other marked curve, and the point of intersection will give a point in the line at right angles to the first line. This has then to be carefully lined out and carried on.

To measure a block nearly a rectangle, a system of give-and-take can be used with fair accuracy. Take a four-sided figure, with a hill in the middle. How can you run a line between the two opposite corner-posts? Take a case when the opposite corners can be seen from the top of the hill. It would seem to be an easy matter to put a peg on top of the hill in line, but how? It can be done as follows:—First take a straight stick, 5 or 6 feet long; sight to one corner, looking from the middle of the stick. Hold the stick steady, and sight it to the other. If you are standing near the middle of the paddock and you find your line is out (say, 20 panels of fencing), you know you have to go about half that

distance to get the approximate line. Then the best method is for each man using a picket to sight one to the back corner, the other ahead, each putting the other alternately on line, until they both come into line. Where several hills or objects intervene it is more difficult to run a line between the two points, but by noting natural features, such as a tall tree near the corner, a line can often be run fairly close.

Another method of finding areas is a graphical method by charting the measurements on a plan to a given scale, and in this connection there is a wonderful little instrument called the planimeter, which by mechanical means does all the calculation of area of a block, no matter how irregular.

The monthly meeting was held on 7th May, when the report of the conference of branches at Inverell on 30th April was received.

A trophy, consisting of a fine silver-plated epergne, donated by Mr. J. Symes in connection with the "what-a-woman-can-do" competition at the recent show, was presented to Mrs. Shaefer, the winner.

Discussion took place on the advisibility of forming a P. and A. Association to conduct the show, which it is felt interferes too much with the regular work of the branch, and it was decided to call a public meeting to consider the matter.

The branch asked for suggestions for the conduct of a garden competition for boys, and the following is the substance of the suggestions of the Department:—

A Suggested Garden Competition.

Of the crops mentioned, onions appear to be the most neglected in this State, and the bulk of the requirements are imported. Anything that would help in popularising this crop within the State, apart even from de-hydrating, should be encouraged whenever possible, and for this reason the Department would suggest the onion crop. Although now a little late for an early crop, it is not altogether too late for planting.

The following rules are suggested, and might be found of use. It will be seen that certain particulars have been left open for the decision of the committee:—

1.—The competition shall be open to boys under the age of...........

2.—Applications should reach the secretary not later than a certain date, giving (*a*) full name and address, (*b*) age last birthday, and date of birth.

3.—The area should be...........

4.—Any variety of seed may be used by the competitor, or seed might be supplied by the committee.

5.—Only one entry should be allowed each competitor.

6.—The time for sowing should be restricted to within a given time.

7.—Each competitor should be required to keep a record showing the dates and particulars of the different operations on the plot, and these records should be delivered to the superintending official when requested.

8.—No competitor shall be allowed to employ any labour on the competition plot other than his own personal labour.

9.—Competitors may be present during any judging.

10.—The decision of the judge, or judges, shall be final.

11.—The aggregate points shall be 100 in Section A., and they shall be allocated in the following way:—

Section A.

Yield	50	points.
Market value of produce	15	„
Evenness of growth	5	„
Freedom from disease	5	„
Thoroughness of cultivation, and general neatness.	15	„
Trueness to type	10	„
	100	

If desired, points may be awarded for two other sections, such as :—

Section B.—Exhibit of a given amount of produce at a local exhibition—

Trueness to type	20 points.
Evenness of bulbs	20 ,,
Freedom from disease and bruises ...	10 ,,
Market value	50 ,,
	100

Section C.—Best record of operations on the garden plot.

Prizes might be awarded for each section, and a further prize to cover the aggregate of the three sections.

Toronto.

A meeting was held on 3rd May, when Mr. C. C. Crane, the Organising Inspector, delivered an address on the aims of the Agricultural Bureau, and was accorded a vote of thanks.

Uki.

A branch of the Bureau has been formed here, with Mr. J. H. McCollum as Chairman, and Mr. W. G. Longley as Hon. Secretary.

Wallsend.

A meeting was held on 18th April, when the greater part of the evening was devoted to the proposal to form a wholesale purchasing department, and arrangements are being made, in consequence, for securing the assistance of other branches to band together to secure one buyer for the district.

On 19th May a meeting was held, at which it was reported that during the month a party visited Hawkesbury Agricultural College. Mr. W. le G. Brereton had visited the district and had given a pruning demonstration of pruning in Mr. F. Bailey's orchard. It was agreed to make an effort to get another demonstration of the same kind.

It has been decided by this branch to purchase a pure-bred Jersey bull with which the herds of members could be graded up to a better standard.

Warrah Creek.

At a general meeting on 19th May trustees were appointed for the machine-gun allotted to the district, and it was agreed to ask for a trophy from the 35th battalion, the branch to discharge all expenses.

The branch has taken a prominent part in obtaining a telephone line for the district, and also in the erection of a co-operative sheep dip.

Efforts are being made to get a few roots of kikuyu grass for members to try for themselves.

Wentworthville.

The autumn show of this branch was held on 2nd April, the Hon. W. F. Dunn, Minister for Agriculture, attending to open the show. He congratulated the branch on its activities, remarking that such a district, in close proximity to the city, should be semi-agricultural in its interests, and should supply a large quantity of fruit and vegetables to the city markets.

The entries for the show numbered 250, and the exhibits were high-class throughout, and an excellent collection of non-competitive products (maize, paspalum, elephant grass, jams, etc.) was made.

The following officers were elected at a general meeting on 27th April:—Chairman, Mr. E. T. Baker; Vice-chairmen, Mrs. E. Friend and Mr. F. Andrews; Treasurer, Mr. E. S. Taylor; Hon. Secretary, Mr. H. Druce.

The report showed that twenty-seven meetings had been held during the year, with an average attendance of thirty-four. Many useful meetings, competitions and displays had taken place, and fifteen lectures had been delivered, while some co-operative buying had also been done. The balance-sheet showed a credit of £9 18s. 2d.

A conference was held under the auspices of this branch on 28th May to discuss the formation of a central body to run a combined district exhibition confined to branches of the Bureau. The branches represented were Quaker's Hill, Kellyville, Auburn, Blacktown, and Wentworthville. A council of the kind was formed, to be known as the "Cumberland United Agricultural Bureau."

Mr. F. Madden was elected Chairman and Mr. H. Druce, Hon. Secretary *pro tem.* A further meeting is to be held early in July, wlen it is hoped every branch in the county of Cumberland will be represented.

Yarramalong.

The members of this branch met on 27th April, when general business was transacted.

Yarrandale.

General business was transacted on 24th May, and a paper was read by Mr. J. Adams on grain sorghums.

The Grain Sorghums.

Treating these crops from the point of view of the wheat-grower, Mr. Adams said he considered the usual "hit or miss" style of growing wheat all wrong, and it was for this reason that he advocated the inclusion of a summer crop and a reduction of the area usually put under wheat. The proportion he favoured was two-thirds wheat and one-third summer crop. For the latter purpose, grain sorghums were well suited. The two varieties he recommended were Feterita and Milo. Both yielded up to 50 bushels of grain to the acre. They took the place of maize where the rainfall was usually insufficient to mature that crop. These grain sorghums recently introduced by the Department of Agriculture were hardy, and matured a crop under adverse circumstances, and in a good year such as the last they were most prolific. In order to reduce the risk of failure he advised at least a short fallow for the area to be put under grain sorghums, thus conserving the moisture and eradicating weeds, especially black oats.

The crop can be harvested for ensilage, hay, or grain; but it is as grain that it is most valuable. Having practically the same feeding value as maize, working horses, poultry, and pigs did well on it.

Until a good market was available for the grain, or provision was made for its consumption by farm stock, Mr. Adams did not recommend putting in large areas, but if he had a proportion of his land under a summer crop, the farmer had more time for the preparation of his wheat area, and the crop was harvested more expeditiously. Should the season prove unfavourable for the wheat crop, he still had the chance of making good on his summer crop. As regards the harvesting method for grain sorghums for small areas, perhaps hand-picking and flail-threshing was best; but large areas could be cut with the binder and put through a thresher, or the crop could be harvested with a header quite successfully.

Departmental Note.—The Chief Inspector of Agriculture remarks that the results indicate that the grain sorghums will be very useful to wheat farmers, particularly those who keep pigs as a side line. If those who keep one or two pigs for their own use be excepted, the number of wheat farmers who keep pigs is very small, for the reasons (in part) of the difficulty of marketing the animals and of securing reasonable prices. The Agricultural Bureau is an organisation that can materially improve conditions in this respect, by enabling farmers who have a few pigs to come together and to make plans that will enable one or more trucks to be consigned at one time. This would reduce the expense of marketing, and would also ensure the best possible prices. A move in this direction has been made by the Cunningar branch of the Bureau, and the results have been so satisfactory that there is now a marked increase in the number of pigs in that district.

Yurrunga and Avoca.

At a meeting on 23rd April it was agreed to obtain a supply of fish from the State fish shops, a few members having already got an order with satisfaction. Members requiring fish place their orders for a month (cash with order), and the chairman weighs out the fish every Friday morning. So far the scheme is working well, and has helped to swell the ranks of the Bureau.

On 27th April a party of members visited Mr. A. Hordern's "Milton Park" property for the purpose of inspecting the cattle. They were shown round by the manager, Mr. Carter, and greatly enjoyed and profited by the day.

Do Bees in Queenless Colonies Steal Eggs?

For several seasons I have noted, when examining queenless and broodless colonies of bees, that occasionally an embryo queen cell will be found to contain an egg. Many apiarists have noted similar cases. Do the bees, then, recognise their utterly hopeless condition at having no queen and no brood from which to raise a queen, and steal an egg from another colony for the purpose of raising a queen? Undoubtedly, the egg is obtained from somewhere, and there seems to be no way in which it can be obtained other than by stealing it from another colony.

One can imagine bees in a queenless condition setting out on such a mission—their battle with the guards at the entrance of the hive it is intended to rob, their reception by its hostile little inmates, and, finally, the difficulties they must surmount in the safe transference of the egg to an embryo queen cell in their own hive. Perhaps the attempt to steal an egg is comparatively common among queenless colonies, success only being rare.

On one occasion this season at the Government Apiary, at Wauchope, there was proof that, at least on some occasions, bees do transfer eggs to embryo queen cells. A few queen cell cups used for queen-raising were left above an excluder on a colony that was about to swarm. On examination after the fourth day, one of the cups was found to contain an egg—an egg, moreover, in a fertile condition, for it eventually produced a queen bee. In this case it seems probable that the egg was transferred from the lower storey where the queen was in occupation; both colour and breeding of the queen point to this.

The transference of eggs as just explained gives rise to another problem: Do bees, when making preparation to swarm, transfer the eggs to embryo cells? It is usually considered that the queen lays the eggs in the cells, but from our recent experience it seems likely that the queen has no say in the matter, and the transfer of the eggs to cells required is carried out by the workers.—W. A. Goodacre, Senior Apiary Inspector.

What Herd-testing Effected.

After six cow-testing associations in New Hampshire, U.S.A., had been at work for two years, nineteen herds showed an average increase in the yield of 763 lb. milk per cow, or an annual improvement in the return of nearly £10 over cost of feed. In six associations that had been at work for three years six herds showed an average increase of 866 lb. milk per cow, and an income over cost of feed of nearly £20 more than the herds formerly averaged. In seven of the associations 216 cows were sold in twelve months, and their places filled by more profitable animals.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1921.

Society.	Secretary.	Date.
Murrumbidgee P. and A. Association (Wagga)	A. F. D. White	Aug. 23, 24, 25
Forbes P., A., and H. Association	E. A. Austen	,, 23, 24
Parkes P., A., and H. Association	J. Heel	,, 23, 24
Corowa P., A., and H. Society	J. D. Fraser	,, 30, 31
Grenfell P., A., and H. Association	G. Cousins	,, 30, 31
Young P. and A. Association	T. A. Tester	Sept. 6, 7, 8
Albury P., A., and H. Society	A. G. Young	,, 6, 7, 8
Gunnedah P., A., and H. Association	M. C. Tweedie	,, 6, 7, 8
Hills District Fruitgrowers' Association (Galston)	R. F. Renant	,, 10
Cowra P., A., and H. Association	E. P. Todhunter	,, 13, 14
Ganmain A. and P. Association	A. R. Lhuede	,, 13, 14
Cootamundra A., P., H., and I. Association	C. H. Inson	,, 14, 15
Northern A. Association (Singleton)	J. T. McMahon	,, 15, 16, 17
Canowindra P., A., and H. Association	John T. Rue	,, 20, 21
Holbrook P., A., and H. Society	J. S. Stewart	,, 20, 21
Temora P., A., H., and I. Association	A. D. Ness	,, 20, 21, 22
Burrowa P., A., and H. Association	W. Burns	,, 22, 23
Henty P. and A. Society	H. Wehrman	,, 27, 28
Junee P., A., and I. Association	T. C. Humphreys	,, 27, 28
Murrumburrah P., A., and I. Association	W. Worner	,, 27, 28
West Wyalong and District P., A., H., and I. Assoc.	T. A. Smith	,, 27, 28, 29
Deniliquin P. and A. Society	P. Fagan	,, 28
Hay P. and A. Association	C. L. Lincombe	Oct. 5, 6
Narrandera P. and A. Association	W. Canton	,, 18, 19
Hillston P. and A. Society	J. E. Peerers	,, 20
Tweed River A. Society	T. M. Kennedy	Nov. 16, 17
Lismore A. and I. Society	H. Pritchard	,, 23, 24

1922.

Society.	Secretary.	Date.
St. Ives A. and H. Association	A. K. Bowden	Jan. 13, 14
Kiama A. Society	G. A. Somerville	,, 25, 26
Wollongong A., H., and I. Association	W. J. Cochrane	Feb. 2, 3, 4
Shoalhaven A. and H. Association	H. Rauch	,, 8, 9
Central Cumberland A. and H. Assoc. (Castle Hill)	H. A. Best	,, 10, 11
Southern New England P. and A. Association (Uralla)	H. W. Vincent	,, 14, 15, 16
Nepean District A., H., and I. Society (Penrith)	C. H. Fulton	,, 16, 17, 18
Guyra P., A., and H. Association	P. N. Stevenson	,, 21, 22
Moruya A. and P. Society	H. P. Jeffery	,, 22, 23
Newcastle A., H., and I. Association	E. J. Dann	,, 22 to 25
Robertson A. and H. Society	E. S. Martin	,, 24, 25
Tenterfield A. Society	E. W. Whereat	,, 28 and March 1, 2
Oberon A., P., and H. Association	C. S. Chudleigh	,, 2, 3
Berrima District A., H., and I. Society	W. Holt	,, 2, 3, 4
Glen Innes P. and A. Society	Geo. A. Priest	,, 7, 8, 9
Campbelltown A. Society	J. T. Deane	,, 10, 11
Cobargo A., P., and H. Society	T. McKennelly	,, 15, 16
Barraba P., A., and H. Association	C. E. Williams	,, 15, 16, 17
Tamworth P. and A. Association	F. G. Callaghan	,, 21, 22, 23
Hunter River A. and H. Association (Maitland)	E. H. Fountain	,, 22 to 25
Camden A., H., and I. Society	C. C. Irving	,, 23, 24, 25
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	April 5, 6
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 10 to 19
Clarence P. and A. Society (Grafton)	L. C. Lawson	May 3, 4, 5, 6

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Agricultural Gazette of New South Wales.

Varieties of Maize and Potatoes.

RECOMMENDATIONS BY THE DEPARTMENT OF AGRICULTURE.

THE Department has recently revised the list of varieties of maize and potatoes recommended for various districts, based on the results of experiments which have been carried out throughout the State :—

Classification of Maize Districts.

The maize districts of the State are classified as follows for the purpose of these recommendations :—

1. Upper North Coast, comprising the Tweed, Richmond, Clarence, Bellinger, and Nambucca Rivers.
2. Middle North Coast, comprising Macleay, Hastings, and Manning Rivers.
3. North Coast Tablelands, comprising Dorrigo and Comboyne districts.
4. Central Coast, comprising the county of Cumberland, and the Hunter and Hawkesbury Rivers.
5. Illawarra, Shoalhaven and Milton districts.
6. Moruya and Tilba districts.
7. Bega district.
8. Northern Tableland, comprising the Tenterfield, Glen Innes, and Armidale districts.
9. Central Tableland, comprising the Bathurst district.
10. Southern Tableland.
11. Inverell district.
12. Tamworth and Upper Hunter districts.
13. Western Slopes, comprising the Molong, Manildra, Mudgee, Canowindra, and Coonabarabran districts.
14. Tumut district.
15. Murrumbidgee Irrigation Area.

Varieties of Maize Recommended for Districts.

UPPER NORTH COAST.

For Grain—

Early crop—Leaming.
Main crop—Large Red Hogan, Fitzroy, Ulmarra Whitecap, and Leaming.
Second-class soils—Hickory King and Leaming.
Blight resistant variety, for December sowing—Fitzroy.

For Green Fodder—Fitzroy.

MIDDLE NORTH COAST.

For Grain—

Early crop—Golden Superb, Funk's Yellow Dent, and Craig Mitchell.
Main crop—Fitzroy, Large Red Hogan, Ulmarra Whitecap, Golden Beauty, and Leaming.
Second-class soils—Hickory King, Leaming, and Golden Nugget.
Blight resistant varieties, for December sowing—Fitzroy and Golden Nugget.

For Green Fodder—Fitzroy.

NORTH COAST TABLELANDS.

For Grain—

Leaming, Small Red Hogan, Golden Superb, and Golden Nugget.

For Green Fodder—Fitzroy.

CENTRAL COAST.

For Grain—

Early crop—Funk's Yellow Dent, Iowa Silvermine, and Craig Mitchell.
Main crop—Fitzroy, Ulmarra Whitecap, and Large Red Hogan.

For Green Fodder—Fitzroy.

ILLAWARRA, SHOALHAVEN, AND MILTON.

For Grain—

Early crop—Funk's Yellow Dent, and Goldmine.
Main crop—Leaming, Fitzroy, Large Red Hogan, and Boone County White.

For Green Fodder—Fitzroy.

MORUYA AND TILBA.

For Grain—

Early crop—Funk's Yellow Dent.
Main crop—Boone County White, Large Red Hogan, and Yellow Moruya.

For Green Fodder—

Fitzroy.
On lighter hillside soils—Hickory King.

BEGA.

For Grain—

Early crop—Iowa Silvermine, Goldmine, and Funk's Yellow Dent.
Main crop—Fitzroy, Large Red Hogan, Boone County White, and Yellow Mastodon.

For Green Fodder—Fitzroy.

NORTHERN TABLELAND.

For Grain—

Wellingrove and Funk's Yellow Dent.
For cooler districts—Golden Glow.

For Green Fodder—

Early sowing—Leaming and Hickory King.
Late sowing—Wellingrove.

CENTRAL TABLELANDS.

For Grain—

Alluvial soils—Funk's Yellow Dent and Iowa Silvermine.
Upland soils—Wellingrove. Funk's Yellow Dent, and Iowa Silvermine.
For colder districts—Golden Glow, Silver King, and U.S. No. 133.

For Green Fodder—

Leaming and Hickory King.

SOUTHERN TABLELAND.

For Green Fodder—

Early maturing crop—Leaming and Hickory King.
Late maturing crop—Fitzroy.

INVERELL.

For Grain—

Main crop—Funk's Yellow Dent and Iowa Silvermine.
For later sowing—Wellingrove.

For Green Fodder—Leaming and Fitzroy.

TAMWORTH AND UPPER HUNTER.

***For Grain*—**

Alluvial soils—Funk's Yellow Dent.

Upland soils—U.S. No. 133.

***For Green Fodder*—**

Leaming and Fitzroy.

WESTERN SLOPES.

***For Grain*—**

Alluvial soils—Funk's Yellow Dent, Iowa Silvermine, and Early Clarence.

Upland soils—Funk's Yellow Dent, Iowa Silvermine, U.S. No. 133 (for September or December sowing).

***For Green Fodder*—**

Leaming and Fitzroy.

TUMUT.

***For Grain*—**

Alluvial soils—Early Clarence, Funk's Yellow Dent, and Craig Mitchell.

"Plain" country—Leaming, Funk's Yellow Dent, and Iowa Silvermine.

***For Green Fodder*—**Fitzroy.

MURRUMBIDGEE IRRIGATION AREA.

***For Grain*—**

Iowa Silvermine and Funk's Yellow Dent (December sowing recommended).

***For Green Fodder*—**Fitzroy.

VARIETIES OF POTATOES RECOMMENDED.

NORTH COAST, CENTRAL COAST, AND SOUTH COAST.

Early Manhattan, Up-to-Date, Satisfaction, Early Manistee, and Carman No. 1.

NORTH COAST PLATEAU (Dorrigo and Comboyne).

Langworthy, Factor, Up-to-Date, Coronation, Carman No. 1, and Queen of the Valley.

NORTHERN TABLELAND.

Coronation, Factor, and Queen of the Valley.

For second-quality soils—Surprise.

CENTRAL TABLELAND.

Factor, Queen of the Valley, Manhattan, Carman No. 1, and Surprise (in addition, Early Rose for Oberon).

SOUTHERN TABLELAND.

Factor, Up-to-Date, Early Manhattan, Queen of the Valley, and Early Manistee.

For second-quality soils—Magnum Bonum.

SOUTH-WEST TABLELAND (Batlow, Tumbarumba).

Factor, Up-to-Date, Coronation, and Carman No. 1.

MURRUMBIDGEE IRRIGATION AREA.

Up-to-Date, Manhattan, Factor, Early Manistee, and Carman No. 1.

Nomenclature of Maize Varieties.

H. WENHOLZ, B.Sc. (Agr.), Inspector of Agriculture.

SOME varieties of maize which have been grown by the Department of Agriculture at the experiment farms have been going under ambiguous names, and it is desired that they should be properly named, so that they may become better known.

In addition, names are also proposed here for some local varieties of merit which have been going under misleading names, or have not been hitherto definitely or expressly named.

Fitzroy (formerly Improved Yellow Dent).—This variety is becoming one of the most popular varieties of maize on the coast both for grain and green fodder. It originated at Grafton Experiment Farm, and is still grown there, having been greatly improved in type during recent years. Owing to the ambiguity of its name, which might be applied to any Yellow Dent maize, a change in designation was desirable. The new name is after a county on the North Coast.

Wellingrove (formerly Early Yellow Dent).—This variety is becoming widely grown on the Northern Tableland, and owing to other Yellow Dent varieties of early maturity being confused with it, it was decided to confer upon it the name given, which has an intimate connection with the location of the Glen Innes Experiment Farm, from which this variety is largely distributed.

Ulmarra White Cap.—This is the name now applied to a variety, which is really a crossbred maize, having a yellow colour and a pale white cap round the dent end of the grain. Owing to its high-yielding capabilities, this variety now takes its place amongst the Department's recommendations on the North Coast. Though it is largely grown on the Clarence River round Ulmarra it has no particular name, but is sometimes referred to as White Cap or White Cap Horsetooth. It is felt that the new designation will more definitely locate and more aptly describe the variety.

Large Red Hogan.—This name is now to be given to the "Red Hogan" maize, which is largely grown on the Hawkesbury River, and which is distributed from Hawkesbury Agricultural College. The new designation is necessary to distinguish it from other types of Red Hogan, such as a narrow-grained type and a small early type.

Manning Silvermine.—This variety has been brought to light by the Manning River maize-growing competitions. It is considered to be the result of a cross between Manning White (a local variety) and Iowa Silvermine, which was introduced from America. It differs from the latter by a later maturity, and a wider furrow between the rows of grain on the cob.

Iowa Silvermine.—To distinguish it from other strains of Silvermine it is preferred to keep to the prefix Iowa for this variety, which was originally introduced from America.

Popular Descriptions of Grasses.

[Continued from page 196.]

E. BREAKWELL, B.A., B.Sc., Agrostologist.

The Wire Grasses.

THESE belong to the genus Aristida. They are called Wire grasses on account of the hard, wiry character of the stems, and, in many cases, of the leaves of the plants.

The genus is fairly common over the warm temperate regions of the world, but usually occurs on the harder or poorer class of soils. In the United States of America, where these grasses are sometimes called Needle grasses or Poverty grasses, many of them serve a useful purpose in the rough hilly pastures, and are often appreciated by stock. In this State, however, only one genus (*Aristida Behriana*), which occurs abundantly on the harder soils of the Riverina, can be said to provide useful feed, and then only in its young stages.

In New South Wales the Wire grasses are common in the warm months on the shaly or sandstone soils of the coast, and on local barren patches on the mountains, tablelands and interior. The drier and more barren the locality the more developed is the wiry character of the grass, and, in the cases of *A. vagans*, *A. ramosa*, and *A. calycina* the flag is small in extent and extremely harsh.

The seeds of the Wire grasses differ from those of the Spear or Corkscrew grasses in having three awns, instead of one, attached. This inhibits the penetrative action on the skin of animals, so usual in the Corkscrew grasses. The free ends of the seeds, however, are generally very sharp, and can do a good deal of damage in the eyes and jaws of stock.

Barley Grasses.

These grasses all belong to the genus Hordeum, of which our cultivated barley (*Hordeum sativum*) is a representative. The commonest species in New South Wales are introduced; they are, *Hordeum murinum* (the common Barley grass) and *Hordeum nodosum* (called Bastard Barley grass, on account of a mistaken idea that it has resulted from a cross between ordinary Barley grass and some other species.)

Barley grass (*Hordeum murinum*) was one of the first grasses that appeared when wheat-growing was introduced, and is probably forty years old as far as this State is concerned. No grass has spread throughout our cereal and partly cultivated pastoral areas, both on the tablelands and in the interior, as this one has done. Whereas Burr trefoil (*Medicago denticulata*), another

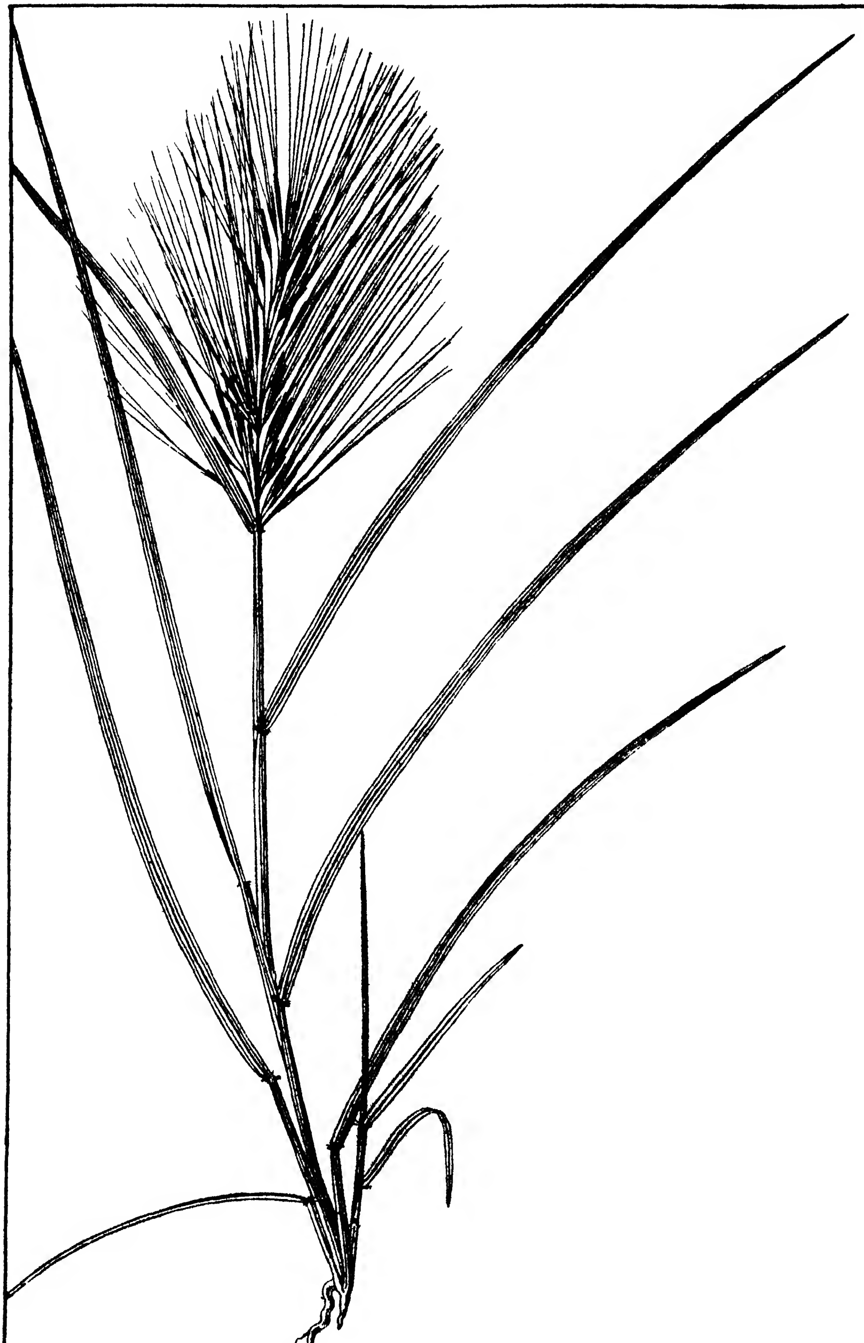


Fig. 1.—*Aristida Behriana*.
Note the three awns or bristles attached to each seed. In the Corkscrew (*stipa*) grasses there is only one.

Fig. 2.—On the left, Barley Grass (*Ho* *n*); on the right (*Hordeum*

The bunch of flowers at the top of the plate is *H. maritimum*. Note that only the central flower is fully developed.

common introduced plant, is more abundant on the slopes than on the elevated tablelands, Barley grass shows no distinction as far as winter temperature is concerned, dry conditions alone affecting it. With good autumn rains Barley grass appears early, and by winter time has practically taken possession of the deep soils. If wheat lands have not been well fallowed, a late sowing will often result in the wheat and Barley grass fighting for supremacy. For the same reason, if the land is not thoroughly cleaned, lucerne sowing in autumn is not advocated in the interior, as Barley grass and other herbage does a considerable amount of damage during the slow winter growth of the lucerne. It is extremely difficult to eradicate the young plants by cultivation, as owing to the fibrous character of the roots, it will retain its vigour with the slightest hold of the soil, being somewhat similar to *Poa annua* in this respect.

Barley grass has certainly come to stay until much more intense cultivation and thorough fallowing methods are carried out. The most luxuriant growth occurs on the western slopes, where it forms dense clumps that grow 2 feet high in the spring. It makes its growth much later on the more elevated tablelands, and appears at its best about November. If the mature plants are ploughed up before seeding on cultivated lands it can be controlled, but in pastures where it seeds so thickly in good seasons, its eradication is practically impossible.

A great deal has been written, and a good deal of data obtained, in connection with the fodder value of this grass. Chemical analysis and other investigations show that it rapidly loses in feeding value on the approach of maturity. In its young stages, however, it provides excellent winter feed. Such succulent feed is particularly useful for the lambing ewes, and in a normal season three to four sheep per acre can be carried on it during a short period of the year.

The seeds of Barley grass are a constant source of trouble, and they prejudice most pastoralists against the plant. The stiff sharp points of the seeds penetrate the jaws, eyes and nostrils of stock, producing in many cases bad sores and decay of the facial bones. The ripe seeds easily break away from the plant, and often lie in thousands per square foot of soil surface. In such cases it is often convenient to burn the pasture at the end of the season.

Hordeum nodosum is a much smaller grass than the ordinary Barley grass, and has finer and shorter bristles to the seed. It is also distinguished by the fact that two of the series of three attached flowers are often considerably reduced, sometimes taking on the form of extended awns. This grass is very common in the Riverina and Blacksoil Plains.

A promising perennial Barley grass is *Hordeum bulbosum*, now in cultivation at Hawkesbury Agricultural College. It grows to a height of 6 feet, yields heavily, and is fairly succulent in texture.

Fig. 3.—On the left, Wheat Grass (*Agropyrum scabrum*); on the right, Combed Wheat Grass (*Agropyrum pectinatum.*)

Note the decided distinction between the flowers of the two species.

Wheat Grasses. (*Agropyrum* sp.)

These are well-named Wheat grasses, as, botanically speaking, they are indistinct from the genus Triticum, of which our cultivated wheats are representative. The Wheat grasses, however, are characterised by being perennial in habit, while the ordinary wheats are of course annual.

The Wheat grasses are very common throughout the temperate regions of the world. The commonest species of all is *Agropyrum repens*, the well-known English couch or quack grass. This grass has underground creeping rhizomes, which possess great vitality, and which are extremely difficult to eradicate. Fortunately it has so far not obtained a hold in this State. An attempt has been made by some people to introduce it, on account of the medicinal value of the roots.

The United States of America possess some valuable Wheat grasses in *Agropyrum Smithii* (Colorado Bluestem), *A. spicatum* (Bunch grass), and *A. tenerum* (Slender Wheat grass). These provide a considerable amount of pasture in the western regions.

The Wheat grasses common to this State are *A. scabrum*, *A. pectinatum*, and *A. velutinum*.

Agropyrum scabrum (Wheat grass) is by far the most abundant. It is common on coast, tablelands, and interior. Owing to its cosmopolitan character it is extremely variable in habit. On sandstone country and on infertile soils it develops very harsh leaves and stems, while on the better soils it is generally extremely succulent. Wheat grass seldom dominates large areas, being content to grow in association with other natives. It is often abundant on the headlands of cultivated lands, on the banks of creeks, and on roadsides. It is a grass that responds well to cultivation, producing large clumps, with succulent flag and stem. It is extremely valuable for winter and spring feed in the coldest of situations.

Agropyrum pectinatum, sometimes called Combed Wheat grass, is mostly confined to the elevated south-western and western portions of the State, such as Cooma, Nimitybelle, Delegate, Blayney, and Gulgong. The grass is characterised by the manner in which the mature flowers align themselves almost at right angles to the stem. Although very palatable, it does not produce nearly the same amount of feed as *Agropyrum scabrum*.

Agropyrum velutinum is also found in cold districts, but produces very little feed.

FUMIGATION *versus* SPRAYING FOR SCALE INSECTS

THE Department's experience is that sprays for scale insects are faulty. Even the best of them are inconsistent in their effects, giving satisfactory results on some trees and poor ones on others. Where fumigation is faithfully carried out it is most reliable and consistent in the results. When fumigation was first introduced years ago, some large citrus growers were rather sceptical of the method, but the same growers soon after the initial test adopted fumigation, and have been among its strongest advocates.—W. J. ALLEN.

The Feeding of Sheep in Times of Drought.

[Concluded from page 496].

[At the termination of the 1919-20 drought, circulars were issued by the Stock Branch with a view to the collection of information on the methods of feeding sheep during the preceding months of scarcity. Valuable information was provided by several stock inspectors and others, particularly by Mr. C. J. Woollett, Stock Inspector at Tamworth. From these replies and other sources, the following excellent article has been compiled by Mr. W. L. Hindmarsh, B.V. Sc., D.V.H., one of the Veterinary Officers of the Branch.—S. D. Symons, Chief Inspector of Stock.]

Green Fodder.

It seems almost an absurdity to refer to the feeding of green crops to sheep during the drought, but where irrigation is possible, it is quite feasible as the following report from a southern district will show:—

Fifteen hundred young crossbred sheep, two, four, and six-tooth ewes and hoggets, were divided into six feeding lots of 250 each. They were fed for twelve out of fifteen months on lucerne, Sudan grass, and barley, all green fodder grown under irrigation on the farm at a cost of 2d. per head per day. They just about held their own, the wool fairly well grown but dry and earthy. Their value at the end of the drought was £2 10s. per head all round. The cost of food per animal was £3 0s. 10d. Some of the feed was sold, and this more than made up for the loss of 10s. per head on the sheep. Away from the river this could not have been attempted, and the cost of feeding would have been great. Lucerne hay was £14 a ton on the trucks.

Other Foods.

Various other foods obtainable locally during the drought were used. Pumpkins and melons were reported upon in one district where they were cheap enough to be fed. They contain a large percentage of water and of the two pumpkins are to be preferred. About 2½ tons of pumpkins are reported to be equal in nutritive value to 1 ton of maize ensilage. The vines when green are good food, but when dry they are very liable to cause death from impaction of the bowels. Pickling onions were used in one case with fair success while they lasted, but the amounts given were not specified. In another instance cabbages that had gone to seed kept sheep in condition while they were available. In America cabbages are prized by some shepherds in preparing stock for the market, but they are too expensive as an article of diet for large numbers of stock. Potatoes have also been fed to sheep with good results. If employed they should not constitute more than one-half of the ration.

Mangolds and turnips were also used, but as with the previously mentioned vegetables, they are not favoured owing (said one report) to the very large quantity necessary (on account of the great percentage of water) and the cost of carriage. Turnips are largely used as a sheep food in England in winter with good results, and if they are available at a reasonable price they should make an excellent drought food.

Bran and pollard are usually too expensive to use for sheep, and (owing to the improvements in milling machinery) they do not contain much nourishment. They are, however, useful when mixed with other foods, since they both contain a large percentage of crude protein matter.

Oil cakes and meals were not reported upon except in a few cases, where they were mixed with other foods. Linseed has always been recognised as a splendid stock food when used judiciously; hence in the above cases the results were reported to be satisfactory. Oil cake broken up to pieces about the size of an almond (known as "nuts") was supplied by certain firms About three ounces of these per sheep per day were fed by broadcasting. The sheep ate them readily and responded well to the additional ration. keeping in fair condition during the dry spell.

Mixed Foods.

From the perusal of the attached reports it will at once be seen that the best results have been obtained from feeding on a mixed ration. It has already been pointed out that no one food is sufficient to keep sheep in good health, for under normal circumstances sheep graze over a wide area, where the feed is varied. According to the season, certain plants will be young while others will have reached seeding stage, and even in the summer months the dried grass and herbage will be accompanied by the seed of various plants. To put sheep on to a limited ration of either scrub, hay, or grain alone and expect them to thrive is not reasonable. The following statements (taken from the reports received from sheepowners in the districts mentioned, each paragraph being an extract from a separate letter) support this view:—

New England.—We bought hay and corn, and started to feed a week after the ewes started lambing. It was rather late; this should have been done while they were strong; 6,142 lambs were reared from 11,428 ewes. A lot of the hay was very bad, or the results might have been 20 per cent. better. The ewes being fed, and condition being kept up, the next lambing was a big one—101 per cent. from 8,000 ewes.

Boiled wheat and scrub (principally mulga) gave better results than hay and corn. Corn is a very fine feed for sheep, especially if started before lambing.

Northern Plains.—Boiled wheat, to which a fair quantity of molasses was added . . . was mixed with chaff and fed. Average for sheep daily was ½ lb. wheat and ¾ lb. chaff. Fed from troughing. Twenty thousand sheep fed for twelve months with good results. Breeding ewes did very well; young lambs did not do so well.

Hand-fed 10,000 ewes on wheat, 4 oz. per day per sheep. After a period they were put on to scrub, and then again on to wheat. The successive alternation on wheat and scrub and the judicious drafting of weaker sheep on to wheat gave generally satisfactory results, but was unsatisfactory with the lambing ewes, where mortality was high.

Western Plains.—Half-pound grain (maize or wheat) and scrub kept sheep in condition, and some owners lambed 30 per cent.

Southern Tablelands.—Fed 1,500 dry sheep daily for six weeks with salt, 200 lb., wheat, 200 lb., linseed meal, 100 lb., chaff, 2 bags (daily ration for 1,500 sheep). The results were good.

Lambing ewes were fed on ordinary hay, including lucerne hay. Four gallons of molasses, diluted with water, and five bags of bran were mixed and fed to the ewes in troughs twice weekly. This gave good results.

Northern Tablelands.—Fed six to eight-week old lambs, not reared by the ewes, two-thirds kerosene tin of corn (dry) and two kerosene tins of bran (corn boiled before used). Fed this amount twice daily to 200 lambs. Loss was less than 5 per cent.

In 1918 I fed 600 Merino and crossbred in-lamb ewes on one bag of corn and 200 lb. of lucerne daily. The ewes did well, and marked 75 per cent. of lambs. I lost only a few sheep.

I fed 800 crossbred ewes on three-quarter bag corn, three-quarter bag bran, three-quarter bag wheat, and seven bags of chaff daily, with an extra bag of bran once per week. I reared 100 per cent. lambs. The corn and wheat I boiled, and commenced feeding while they were in good condition.

We found that ewes produced more milk on a ration of wheat, salt, and box leaves than on lucerne hay, chaff, and maize, although the conditions were worse in 1919 than in the previous year.

I gave one and a half bags corn and 2 cwt. lucerne hay to 1,000 ewes daily. They ambed all right, but when the lambs were two months old they died down to 40 per cent.

Fed 900 ewes (700 crossbred and 200 Merino). Feeding commenced a week before lambing, and was continued seven weeks. I gave 3½ tons lucerne hay and 1½ tons wheaten chaff per week, together with two bags daily of crushed wheat. The ewes did well. The lambs would improve for a week or ten days, and then they would fall away and become poddy. I marked 420 lambs from the crossbreds, but only forty-two from the Merinos. I lost twenty-five of the Merinos, although they had the better care and attention.

We fed 500 ewes and lambs for four months on bushes, together with 6 oz. of bran and pollard daily, with good results. These sheep would not have done on bushes alone.

In 1917 we fed 500 Merino ewes in lamb. We started with 4 to 4½ oz. maize daily, scattered. This was unsatisfactory. We then fed in wooden troughs 12 bushels of steeped maize, one bag of bran, and about 100 lb. of lucerne chaff daily. We marked 330 lambs, but lost fifty ewes. In 1918 we fed 600 Merino ewes on a daily ration of one bag of steeped wheat, one bag of bran, 1 cwt. of good wheaten chaff. We marked 460 lambs, and lost thirty ewes.

Nine hundred crossbred ewes were fed a fortnight before lambing as follows:—(1) 400 fed on lucerne hay and corn, hay sprinkled with molasses and corn broadcasted. Fed twice a day, giving half a kerosene tin of corn and a small spring-cart of hay. Ewes, did well, but a number of lambs died, as ewes did not have sufficient milk. (2) 500 fed on chaffed lucerne hay sprinkled with molasses and fed in troughs. Sheep had four wheat bags of chaff and two kerosene tins of corn. To this I added epsom salts and salt twice a week. These ewes made more milk, very few lambs dying.

I gave 1 lb. chaff and ¼ lb. wheatmeal daily sprinkled with salt water and molasses. This will keep a sheep strong and healthy. When lambs are six to eight-weeks old you can feed them this way with their mothers with feed in bag troughs. To feed dry sheep, 3 oz. of maize per day, as well as filling up with box and apple leaves, will carry them on for months, but they need some laxative lick. We fed 15,000 to 20,000 at times during the drought.

METHODS OF FEEDING.

When scrub is to be fed, it may be lopped as required. One man can lop sufficient for 800 to 1,200 sheep, according to local conditions. Ensilage and hay may be (*a*) scattered through the paddock, a hard dry spot being selected as a site and frequently changed, or (*b*) fed from troughs. The first-mentioned is not an altogether satisfactory method, as the feed may be trodden into the dust and wasted. Trough feeding is the better and more economical method. Especially is trough feeding necessary if the feed has been damped; otherwise earth and sand will adhere to it.

Troughs may be made (*a*) of bags or hessian, or (*b*) of boards. If bags or hessian are used, the trough should be so contrived as to prevent the bottom being lifted by the wind and the food thrown out. A wire running the full length of the inside of the trough will prevent this. The disadvantage of bag troughs is that with constant use they rapidly wear out. To make a board trough, peg two 6 or 8 in. planks into the ground in a vertical position about 8 inches apart, and water and ram the earth between to make a hard bottom. A rider is necessary in this case to prevent the sheep from getting into the trough.

It is essential that chaff be fed from a trough. Grain, too, is preferably to be fed from the trough, though it may be broadcasted on to hard dry ground. In trailing or broadcasting there is less waste with maize than with the smaller grains. When trailing it is advisable to drive in a circular or a U-shaped track. This gives the weaker sheep a chance to get their share.

The following reports (taken from the letters received from sheepowners in the districts mentioned, each paragraph being an extract from a separate letter suggest some other methods of feeding which might be adopted where suitable :—

Southern Tablelands.—Troughs should be made of hessian, hung on small posts, with a wire run along the bottom of the trough to prevent it being blown up by the wind. Each trough should be 100 yards long for every 500 sheep.

Central Tablelands.—Hay racks may be made by bending a roll of wire netting, about 2½ inch mesh, between the poles and fastening it securely at each side. A roll will go 90 yards. The bottom in the netting should not be more than 1 foot off the ground. All hay should be fed from racks.

Southern Plains.—A good troughing can be made of hessian, sold in rolls 50 yards by 6 feet wide. This, split down the centre, makes 100 yards of troughing. When erecting, fasten it well down at the bottom at each pair of posts. This prevents the bottom being lifted by the wind. Two hundred yards of troughing are required for 1,200 ewes. It may be necessary to separate the weak.

The troughs may be arranged in parallel lines or in square formation, says the writer of this report. From the sketch provided, it appears that if the troughs are arranged on the square, the troughing forming the sides should not meet at the corners, but should leave room for the sheep to move in and out of the square, and to approach both sides of the troughs. If the troughing thus forming the incomplete sides of the square measures 50 yards, the space across the corners should be 15 yards.

Northern Plains.—Good results from feeding grain from sheets of iron. The roof of the shearing shed was removed and the sheets of iron placed end to end. The grain was scattered along this. By this means the contamination of the food with earth and sand was avoided.

Preparation of Food.

Reference has already been made to the necessity for the addition of molasses, salts, &c., to the food. When it is decided to steep the food beforehand a solution of these medicaments will be found useful. In some cases food may be available which, owing to its inferior quality or to deterioration, should be treated in order to make it more palatable and non-injurious. Boiling or soaking the grain before use has no especial advantage, except in the case of very weak or very young sheep. The following reports show methods adopted with success :—

Southern Plains.—Bales of straw were placed in an iron tank, filling the same with molasses and water and leaving twenty-four hours. The bales were then lifted with a derrick and allowed to drain. They were then taken to the paddocks and left for the sheep to tear to pieces.

New England.—With the aid of a suitable steaming plant much roughage which would otherwise waste can be made into good and digestible stock food. I have seen in past droughts rough, stalky, and sometimes musty, lucerne hay, straw, lucerne straw, hard stalky stuff after the seed has been threshed from it, the rakings up from the haystack and sheds, chaffed roughly and put through the steamer, allowing about thirty minutes to cook, turn out palatable and good stock food. Salt and molasses may be added when necessary. Breeding stock did particularly well on it.

Northern Tablelands.—Ewes would not rear the lambs. Took 200 lambs, from six to eight weeks old, and fed them on one kerosene tin of boiled corn and two kerosene tins of bran, with a loss of 5 per cent.

Southern Border.—One stack of hay was not fresh, the hay being dry. We damped this with brine and fed a lot of four-tooth wethers. Results were satisfactory.

Northern Plains.—Maize germinated before feeding gave the best results.

Cost.

No estimate of the cost of feeding can be submitted, as it depended largely on the local conditions and cost of fodder, but the following reports (taken from the letters received from sheepowners in the districts mentioned, each paragraph being an extract from a separate letter) are, nevertheless, o value :—

Western Plains.—One man is capable of providing scrub for 1,000 to 1,500 sheep daily. The cost of feeding by scrub cutting is estimated at 1½d. per head for sheep for a period of six months.

Northern Tablelands.—Sheep fed on wheat and scrub. Wheat trailed from spring cart. Not satisfactory as regards ewes. Low-grade wheat bought at 10s. and 11s. a bag. Cost of feeding 14s. per sheep, including labour, per year.

Fed wheat and scrub. About 4 oz. wheat per sheep per day. Cost of feeding, without labour, was 4s. 1⅛d. per sheep per year.

New England.—Lucerne hay, maize and bran fed twice a week. Two men with two carts fed 6,000 sheep for seventeen weeks, three teams carting from the station 12 miles—cost, £2 per day.

One thousand sheep (lambing ewes) fed four weeks. Used 100 bags of maize at daily cost of £5, including labour.

Hay, £5 ton; 1½ lb. per day per sheep, 5⅝d. per week. Maize, 4s. 8d. bushel; ½ lb. per day per sheep, 3½d. per week. Labour putting out feed, 1d. per week. Total cost per sheep, 10⅛d. per week.

Central Northern.—Cost of pitting ensilage of trefoil, crowfoot, and variegated thistle, 11s. per ton. Two men with cart and two horses can feed 3,000 sheep per day. Two hundred and fifty tons cut off less than 20 acres.

Central Western.—Pumpkins when first fed were 30s. a ton. They rapidly rose to 90s., at which price they were prohibitive.

Green fodder fed to sheep was green lucerne, Sudan grass, and barley grown under irrigation, at cost of 2d. per head per day.

Half a pound grain and ½ lb. hay per sheep per day. Cost £8 per 1,000 per day.

Quarter to ½ lb. corn at 10s. 6d. bushel; ½ lb. hay at £14 ton (landed). Cost of 8d. per head per week for dry sheep, and 10¾d. per week for ewes in lamb.

Over-wintering of Spotted Wilt of Tomatoes

Tomato plants infested with the spotted wilt disease have been under observation in a suburban garden throughout the winter, to test whether or not the disease winters in the old plants. One old vine, still alive, is at present (11th July) showing the typical symptoms of the wilt—the bronzed appearance of the leaves and young shoots. As some growers have already commenced to plant out early seedlings, the possibility of them being infected from old vines is apparent. While the exact method of transmission of the disease from plant to plant is unknown, it would be wise for growers to destroy all old vines by burning before commencing to raise early seedlings.—C. O. Hamblin, Assistant Biologist.

When feeding sugar syrup to bees affected with dwindling, it is not necessary to remove the ordinary stores from the hive, for when the bees remove the syrup from the feeding combs it is placed by them in a position convenient for their immediate use. It will therefore be consumed early, and in preference to the ordinary sealed stores.—W. A. Goodacre, Senior Apiary Inspector.

Co-operative Factory Managers and Secretaries' Conference.

Winter Butter Show, 1921.

L. T. MacINNES, Dairy Expert.

The butter exhibited in the various classes customarily competed for at this show was, if anything, of somewhat better all-round quality than usual. Scores of 95 and 96 points were reached in some instances with, and in others without, the assistance given for improving flavour by the addition and use of a starter.

This year a new class was inaugurated—the "Robert Manning." In this competition, two boxes of butter of each competing brand were picked up on the wholesale distributing merchants' floors in Sydney in January. These were judged by the State Grader and placed in cold storage for five months, and then brought out, defrozen, staged on the benches at the winter show, and judged again. The brands scoring the highest aggregate number of points on the two judgings were awarded the leading places. This was an extremely severe test, far in excess of the requirements of local and export trade. For the latter, a storage of six weeks or two months at the most would suffice, because any butter manufactured here and exported to England would be disposed of there for consumption in ordinary years within two months of the date of manufacture. The test for keeping quality is severer than that of the "blue ribbon" or "continuous competition" of the Royal Agricultural Society. Of all the classes at the winter show the Manning was the most important, and the winning of it was most coveted by competitors. The quality of the butter entered showed that a large quantity would not stand a five months' storage test, although able to pass as of choicest grade for the requirements of the local trade for which it was made, that is, for consumption within at least ten days after being manufactured. To keep its quality for long periods, butter such as is needed for winter pools requires special attention in its manufacture, necessitating a stricter grading of cream with the exercise of the utmost care in its neutralisation and pasteurisation.

Month of Manufacture.

The month chosen to collect samples for judging was January, that month and February being the two worst months of the year from a butter manufacturer's point of view. To cap the usual difficulties experienced at this time, we had this year a rainfall above the average, and with it an abnormally humid heat. Attendant on these conditions was a mould epidemic.

Under-equipped Factories.

New South Wales dairy produce factories, in common with similar institutions in other parts of Australia, were allowed to become to a certain extent below the standard of efficiency on account of the difficulty, and in some cases the impossibility, of replenishing plant and financing the purchase of new equipment, renovating old premises or building new ones during the period of the war. The two years following were drought, and the small supplies of cream brought the finances of both companies and dairy-farmers into a worse state. Immediately following these unfavourable years came last year's bumper season. Factory managers had to treat supplies 37 per cent. above those of the previous year, and in a great majority of cases the manufacturing plant and engine-room power were insufficient to cope with the rush, the result being that employees had to work extra long hours, often finishing after dark. Temperatures for pasteurising, cooling and chilling cream, water and cold chambers, could not be controlled properly. Only those visiting factories working under such conditions can have any conception of the difficulties under which butter was manufactured during the height of the season 1920–21.

In connection with the "Robert Manning" competition the butter exhibited had also to suffer in very many cases from having to lie some considerable time on the wharves, railway trucks, and the agents' floors in Sydney at last summer's muggy temperatures, before being put into the freezing rooms.

The Result of Two Judgings.

There were fifty-four boxes examined. Taking the points scored for flavour, which is the determining factor in classifying a butter suitable for the local trade, there were, at the first examination last January,

31 scoring 43 points and over.
13 ,, 42 ,, ,,
9 ,, 40 and 41 points and over.
1 ,, under 40 (unpasteurised, fishy and oily).

On these figures, 81 per cent. out of the total scored 42 points or over under the extra strict grading to which show butters are subjected. The second examination, made five months later, demonstrated that 21 per cent. or twelve boxes had held their quality and were still 42 points and over, five out of the twelve grading 43 and over; thirty-one boxes scored 40 and 41 points, and eleven were of second grade. Of the whole exhibit, therefore, 80 per cent. was first grade and over. Taking into consideration the adverse circumstances under which this butter was made and kept before going into cold storage, and the very long period it was held in the cold rooms (at about 10 degrees to 15 degrees Fah.), New South Wales managers and butter-makers have come fairly well out of the trial. I think it can be safely said that under similar conditions, the result could not be surpassed or equalled in the other States, and I doubt very much if fifty-four boxes or kegs of best quality butter were haphazardly picked up in Denmark or New Zealand and

kept for a similar length of time at the same temperatures, whether the percentage to score first grade points and over for flavour, at the expiration of the period, would exceed the New South Wales 80 per cent.

Those twelve factories that had butter scoring 42 points and over for flavour at the second examination on 22nd June, are to be congratulated on the result, especially the winners of the competition—the Kyogle Co-operative Dairy Company (first), and the Binna Burra Co-operative Dairy Company and North Coast Co-operative Company's Uki branch, which divided second prize. It is worth noting that all three of these factories are located in the extreme North Coast, where climatic conditions are the worst for butter-making, and that while the winner used a holding-system pasteuriser, the runners-up used the flash-system. It is thus demonstrated that the causes of deterioration can be controlled in all factories in spite of heat and a wet, steamy climate. It shows that where the plant is equal to the demands made upon it, where cream grading, neutralisation and pasteurisation are efficiently done, and the work not slummed, butter can be made that will stand up against far harder trials than it might be reasonably expected to undergo, and yet emerge successfully.

Hard though the conditions are that govern this competition, they should not be modified, for to prove the possibility of manufacturing an article that can come through such a judgment, and be classified at the final as still choicest quality, is well worth while. Next year, instead of having 80 per cent. of the exhibits first grade and over after five months' storage, it is most desirable that there be 80 per cent. choicest, and 20 per cent. first grade. It should be regarded as a decided reflection, too, if there is any score under 43 points for flavour at the first grading. The goal is not unattainable, and if our managers and butter-makers have the necessary plant, and have not to rush their work through or work too long hours, they should be able to do it. They have the knowledge, the training, and the ability.

The Value of the Local Trade.

It is right that the principal class at the show should have been for butter that was submitted for sale for the local, State, or interstate trade, because this is by far the most important market we have, judging by the quantity disposed of, as compared with that exported overseas. In New South Wales during the past twelve months, local consumption averaged 20,000 to 22,000 boxes, or, say, 500 tons a week, equal to 26,000 tons for the year. This huge amount is increasing by over 1,000 tons a year, with the normal increase of 80,000 to 90,000 in population. Should a big stream of immigrants commence to pour in, consumption would the more quickly overtake production, unless the latter increased very much.

Since 1906 production has been increased, but it has not nearly kept pace with the State's increase in consumption. In 1906 (a normal season) we exported four boxes to every five boxes consumed locally; in 1917-18 (a good season) four boxes were exported to seven required for local consumption; in 1919-20 (a drought year) it was four export to twenty-two local; while for the past year (an abnormally good season) the ratio was four export to eight local.

Over and above the large consumption within New South Wales, the interstate trade takes 1,000 to 1,500 boxes a week, or, say, 1,200 tons a year. The demand, both in interstate and local trade, is for choicest quality only, and as the consumption is so great, it is quite evident that very little choicest grade butter is left over for export to England, especially when the regular Eastern trade with choicest brands is deducted from the exportable surplus.

By the way in which the quantity of New South Wales butter required to fill Australian normal needs is increasing each year, it will only take another eight or ten years to overtake production in this State, and only the most inferior grades will be available for export.

GRADES of butter manufactured in New South Wales, showing regular increase in percentage of choicest.

Year.	Choicest.	First Grade.	Second Grade.	Total Production.
	per cent.	per cent.	per cent.	lb.
1916-17 ...	77·6	17·1	5·1	74.824,237
1917-18 ...	81	14	5	76.628,160
1918-19 ...	85·6	10·8	3·6	61 655 503
1919-20 ...	85·9	10·3	3·8	59,972,883
1920-21 ...	88	8	4	81,530,000*

* The last two months (May and June) estimated.

It has been stated that Australia, and New South Wales in particular, should increase the percentage of choicest butter in the quantity exported. This cannot be done unless local consumers are given the inferior butter to eat and a corresponding proportion of the best is added to that exported. Those who advocate this do not know, or if they do they wilfully shut their eyes to the fact that in Sydney and elsewhere in this State the people have been educated up to eating only the best butter, and any attempt to foist the lower qualities on them would be followed by disastrous effects on the merchant's trade who would be bold enough to try it. It is all very well to talk about sending better butter overseas to gain a reputation for high quality. When such butter is not available, it cannot be done. In New South Wales of late years there has been a marvellous improvement in quality—that improvement is still going on, but the increase in local demand is more rapid, so that each year there is a decline in the percentage of choicest and first grades sent to England. It is comparatively easy to increase the percentage of choicest from 40 to 70 per cent., but far harder to get from 80 to 90 per cent., and the nearer we get to *all* choicest, the more difficult the task becomes.

New South Wales, however, keeps going forward. Five years ago we had 76 per cent. choicest; last year it was 85 per cent., this year we have reached 88 per cent. It is doubtful if a higher standard than 90 per cent. choicest will be attained for many years to come.

INCREASING quantity of butter needed for local consumption and corresponding decrease in choicest exported.

Year.	Butter for Local and Interstate.	Total Choicest Manufactured.
	lb.	lb.
1916-17 (average season)	54,000,000	58,000,000
1917-18 (above average)	55,500,000	62,000,000
1918-19 (below average)* ...	57,000,000	52,750,000
1919-20 (below average)* ...	58,750,000	51,500,000
1920-21 record, above average† ...	61,000,000	74,000,000

* In these years the local market required to be supplemented with first grade.
† On average production for last five years, and allowing 88 per cent to be choicest grade, there would have been manufactured last year only 62,500,000 lb.

The average production of butter for the last five years has been approximately 71,000,000 lb., and the estimated consumption for the next year is 63,250,000 lb. Even if the proportion of choicest butter is as high as 90 per cent., there will still be only a surplus of slightly under three-quarters of a million pounds of that grade to export, unless local requirements are met in part with butter of an inferior quality. By 1923 we should be able to more than absorb locally the whole of the choicest grade, estimating it at 90 per cent. of the present average production.

There is only one way to increase our exportable surplus of choicest grade, and that is to increase production—increase it in greater proportion than the increase in population and consequent increase in local consumption. Strong efforts are being made by the State Dairy Branch and eminent public men to bring this about, especially by promoting and organising the testing for production of the dairy herds, their better feeding, and improvement in breeding to bring them up to a higher standard.

ELEPHANT GRASS AT NORTH RYDE.

MR. N. S. GUNTHER, North Ryde, has experimented with elephant grass for over two years, and provides some interesting data. He planted the clumps on high land, and states that "from observations it would appear that, without artificial watering, although it may not be equal to maize, nevertheless, on account of the long period it remains green—from early spring until late autumn—it deserves a place on the farm, particularly in the numerous odd corners where the plough or cultivator cannot reach." From a single plant eighteen months old, he obtained 124 lb. of green feed which he chaffed and fed to stock with satisfactory results. He states that by 28th May, although some of the stems were still green, a good 50 per cent had been lost in weight. He again chaffed and fed it to a Jersey cow with good results. The hay was particularly appreciated.—E. BREAKWELL, Agrostologist.

Co-operation for Farmers.

C. C. CRANE, B.A., Organising Inspector of the Agricultural Bureau.

MUCH has been written on this subject, but the object of the present paper is to set forth in a simple form some of the principles of co-operation in the hope that they may serve as a practical guide to rural communities when pioneering co-operative enterprises in their own districts. The principles on which the "Rochdale pioneer movement" was built, are the basis of all successful co-operation throughout the world, and may be briefly numerated as follows:—

1. Interest on shares not to exceed a given maximum.
2. Shares always remain at par, because interest is fixed at current rates.
3. Control of business to be democratic—one man one vote.
4. Voting to be done in person—not by proxy.
5. Selling price of goods to be at current market rates.
6. All sales for cash.
7. The margin between wholesale and retail rates, commonly called "profits," to be refunded periodically to purchasers in proportion to the amount purchased.

It is realised that co-operative manufacture and distribution are the real goals at which producers must aim, and this fact is evidenced by the growth in this State of two clearly-defined groups of co-operators, viz., producers and consumers. On the other hand, since all producers are consumers and less obviously *vice versa*, producers might with real advantage associate themselves with consumers' co-operative concerns. The establishment of co-operative stores may be advocated for the following reasons:—

1. Consumers' co-operation requires less organisation, less outlay of capital, and involves little or no risk.
2. It will show quick returns in hard cash, and furnish facts and figures which will serve as invaluable propaganda.
3. It will foster the community spirit, and indicate ways in which the co-operative store may become a co-operative movement.
4. An affiliation of local co-operative societies will pave the way for an agricultural co-operative wholesale society.
5. Such a co-operative wholesale society would provide the machinery for co-operative manufacture and distribution.
6. Co-operative credit will be developed.

Thus it is claimed that the co-operative store is but the first rung in the ladder of the co-operative movement. A wholesale society built on an affiliation of local societies would be infinitely more appealing and democratic than a similar organisation that was organised from the top.

Preliminary Considerations.

Co-operation has been hampered by (*a*) the lack of co-operative legislation, (*b*) the existence of many concerns which are co-operative only in name, and (*c*) lack of co-operative propaganda and education.

Since many people are suspicious of the movement, having previously participated in premature and ill-considered ventures that have ended in financial loss, the formation of a simple local undertaking involving the smallest possible risk, and yet showing practical results in economy, may be advocated as a means of arousing co-operative interest first and enthusiasm as a natural consequence. The results should be intelligently used as material for propaganda for further developments, which will involve the outlay of capital and will call for the unswerving and loyal support of the members. No beginning can be too small, provided that (*a*) practical results are achieved, and (*b*) that such results are used as propaganda. Co-operation is a movement which should develop from the beginning in every case, so that each and every member will realise the economic and community value of co-operative methods. It is not just a "cheap store" movement. It is a movement that embodies a big ideal of community service and that therefore calls for more than nominal support. In every sense of the word it is a "get-together" or "community-business," and its beginnings will be on a scale commensurate with the "get-together" strength of the few who set the movement working in any district.

Pool-buying of Special Requirements.

A co-operative undertaking involving little risk, requiring little organisation and yet capable of showing big returns, is the co-operative for pool-buying of special requirements. By buying in bulk in advance of actual requirements, on the best market and for cash, and by taking advantage of wholesale prices, by reducing the number of middlemen between the wholesaler and the consumer, and by the reduced railway freights on big consignments, several farmers in a district could with advantage pool their orders for certain kinds of requirements, and effect substantial economies. One man should act as secretary, obtain quotations from as many sources as possible, receive orders and cash from those co-operating, despatch the orders, and arrange to receive the goods. Mutual arrangements would then have to be made for dividing the consignments into small parcels ready for distribution. This necessarily involves a good deal of trouble for one or more of the members, but the experiment is worth trying, for a few trials will prove the economy of the effort, and will indicate that it would be economical to arrange to pay someone to do the parcelling and to give delivery. Of course this implies a middleman, but co-operation does not aim at eliminating middlemen—it aims at (*a*) substituting a co-operative employee for the speculative middleman, and (*b*) reducing the number of middlemen.

Examples of successful work of this nature are not wanting, and the following particulars supplied by the secretary of the Milbrulong Agricultural Bureau Trading Society regarding the methods of that body, are worth the study of such communities as have not yet made the experiment.

The Milbrulong Agricultural Bureau Trading Society.

The Society commenced operations in March, 1920, with the following objects:—

1. To obtain farmers' requirements at the lowest possible cost.
2. To bulk purchases in order to obtain the lowest railway freights.
3. To eliminate middlemen and agents as far as possible.
4. To bring farmers into touch with the markets for farm produce and farm requirements.

The first move was a special meeting at which the venture was discussed, a committee of seven was appointed to control the business, and the secretary was instructed to write to various wholesale houses for quotations for farm requirements. A date was then fixed for the first meeting, at which orders would be taken.

At the "order meeting" the quotations received were read by the secretary, the members present making a note of their requirements. Each then signed his list and handed it to the secretary, who then made up the total orders into one large order and despatched it to the firm quoting most reasonably.

To enable cash to be paid for the goods upon receipt of invoice all members signed a guarantee for an advance of £1,000 from the bank. This proved very successful, as during the first six months of operations the interest on the amounts borrowed amounted to only 14s. 1d., while the discounts received in consequence of paying cash within the three, seven, or thirty days, as the case might be, amounted to £12 10s. 4d.

To the cash price and freights on the goods, a handling charge of 2½ per cent. was added, of which 1½ per cent. was paid to a man who was appointed to take delivery of the goods on arrival, and to distribute them to members as ordered. The remaining 1 per cent. was retained to cover banking and secretarial expenses. After six months of operations it was evident that the 2½ per cent. was sufficient to cover all expenses. All members have to pay cash for goods on delivery. This is necessary to safeguard the venture from bad debts, &c. One rule provides that only *bonâ fide* farmers can be appointed to the committee in order that agents may be prevented from obtaining control in the society.

During the first six months the following lines were handled successfully:— Oils, binder twine, seaming twine, cornsacks, wire, benzine, kerosene, groceries, and other smaller farm requirements.

On an average about 20 per cent. was saved over local prices—in some cases as much as 60 per cent. Some farmers bought up to £150 worth of goods during the first six months of the society's operations, and the saving to them was substantial.

The turnover for the first six months, during which three "order meetings" were held, was £1,587 16s. 6d.; and for the first twelve months, £3,016 16s. 2d. Latterly it has been considered unfair to receive such services as the secretary renders without reward, and it was decided to

increase the charge of $2\frac{1}{2}$ per cent. to 5 per cent., and to allot it as follows: secretary, $1\frac{1}{2}$ per cent.; distributing agent. $1\frac{1}{2}$ per cent.; bank charges, 2 per cent. A feature which has proved of the greatest convenience and economy has been the accommodation afforded by the bank at Lockhart.

The movement has met with such marked success that people have come fifteen to twenty miles to place an order for goods. The members recently decided to commence a farmers' co-operative store, and promises of 3,000 shares of £1 each were received, but owing to the financial difficulties attendant upon the wool position, and the deferred payments for wheat, it has been decided not to proceed at this stage with the establishment of a co-operative store, the members preferring to register as a co operative society and to build a shed to facilitate the continuance of the present system.

The following are the rules and regulations under which this trading society acts:—

RULES OF MILBRULONG AGRICULTURAL BUREAU TRADING SOCIETY.

1. That the Milbrulong branch of the Agricultural Bureau form a wholesale, retail, buying and selling association, to be comprised of all financial members of the Bureau.

2. That seven directors be appointed with the president and secretary *ex-officio*. The directors to be appointed at the annual meeting, ten days' notice of such meeting to be given by advertisement in the local papers, or by circular.

3. That the directors be empowered to make such banking and financial arrangements as may be necessary to carry out the objects of the Milbrulong Agricultural Bureau Trading Society.

4. That the directors, together with all members, be guarantors for all liabilities and contracts made and entered into by the directors, the directors being empowered to relieve any member of being a guarantor.

5. That the directors be empowered to acquire any business, agency, or agencies to carry out the objects of the Bureau Trading Society. Such acquisitions to be confirmed by a two-thirds majority of the members at a meeting called for the purpose.

6. That no person be eligible to hold a position on the executive who holds any interest in any buying or selling business or agency outside his own business as a primary producer.

7. That a majority of directors present will form a quorum.

8. That the directors be empowered to obtain such legal advice as may be necessary to carry out the objects of the society.

9. That all business and trading be carried out on a strictly cash basis.

10. That all orders for goods be paid for on delivery, with such addition to the cost price as will be necessary to cover freight, cartage, storage, and handling charges, as determined by the directors.

11. That the secretary keep a copy of all outward correspondence, and present all inward correspondence to the directors at their meetings.

12. That the secretary shall prepare and submit a financial statement at each quarterly meeting of members to be summoned by the directors.

13. That a special meeting of members shall be called to receive orders at such time as the directors think fit.

14. That all orders, when a shortage occurs, be distributed on a *pro rata* basis.

15. That (*a*) the president and secretary have power to sign all cheques, bills of exchange, and promissory notes on behalf of the association; (*b*) the secretary to have the power to endorse all cheques, bills of exchange, and promissory notes.

16. That any alteration, deletion, or addition to these rules be made by a simple majority of members present at a meeting for such purpose.

These are the actual working rules of the society, which is conducted as an unregistered co-operative concern. The practical results of this society are indicated by the savings to the members, estimated by the directors of the concern, in the purchase of the following lines :—

> Sheep salt, 15s. per ton ; bluestone, 3d. per lb. ; jam, 5d. per tin ; sugar, ½d. per lb. ; black wire, 5s. per cwt. ; barbed wire (galvanised), 15s per cwt. ; barbed wire (black), 25s. per cwt. ; molasses, 8s. per cask ; kerosene, 2s. per case ; benzine, 2s. 6d. per case ; Epsom salts, 7s. 6d. per cwt. ; plough discs, 10s. each ; one-way discs, 7s 6d. each ; steel shares, 27s. per doz. ; machinery oil, 1s. per gallon ; tools, chains, &c., 20 per cent. ; bran bags, 1s. a doz. ; flour, 3s. a bag ; waterbags and pitchforks, 25 per cent.

Undoubtedly bulk buying of requirements has much to recommend it, for it offers real facilities for economy, and at the same time does much to foster the "get-together" movement so urgently required in farming communities. It affords excellent material for propaganda, but while making it possible for goods to be obtained more cheaply than would be the case were they obtained through an established co-operative store, the method suffers from the following disadvantages :—

1. It concentrates much work and worry upon one or two of the members.
2. It enables the many to effect real economies at the expense in time and thought of the few.
3. It makes no provision for laying in a stock of commodities, and purchasers are restricted to leading lines.
4. It does not afford the machinery for linking up readily with similar bodies with a view to forming a co-operative wholesale society.
5. It necessitates dealing with proprietary wholesalers or agents, thus limiting co-operative activity.
6. It does not enable the members to purchase land or erect buildings, as, not being registered, the society has no legal status.
7. Not being registered, no legal protection is afforded its members against delinquent employees.

As is indicated in this description of the Milbrulong activities, the stage has been reached when it is deemed advisable to take the next logical step in the co-operative movement, namely, the registration of the society. There are two courses open to such a progressive community : the one to erect and stock a co-operative store, the other to buy out a local store. To follow either course requires registration as a company. To buy out the local store has much to recommend it, in that it removes the first source of opposition, but it may be too big an undertaking for a young society. Still, with the valuable experience and facts at the disposal of the society, the co-operative strength of the society should be sufficient. It is worth noting at this stage that many of the most successful rural co-operative concerns in Victoria have bought out a local storekeeper, thus starting off with a going concern. Against such a course is the consideration that a "good-will," of no real value to co-operation, has to be paid for.

A Registered Co-operative Society.

The following description of the co-operative concern at Miranda is furnished by the secretary. It describes a society which registered as a co-operative society in the first place, and it is therefore a useful demonstration of a different stage in the co-operative movement.

The Miranda Agricultural Bureau, Limited, was established in 1917 for the purpose of acquiring a meeting place for the branch, and to obtain supplies for poultry farmers and others. It is a trading company, run in conjunction with the local branch of the Agricultural Bureau. It was started in a humble way, without any great pretensions, the officers and directors carrying out the work free of expense, thus conserving everything for the benefit of the company. A building that had been used as a church was purchased; shares at £1 each being issued either fully paid up, or paid up at 2s. 6d. per month. A truck of wheat was purchased from the wheat pool as a start, and a carter was engaged by contract to deliver the grain to the members.

This initial venture proved to be a great success. By adding 5 per cent. to the price of goods, the selling price covered all expenses incurred, and left a surplus to help strengthen the society's finances. Some members who had only taken up one share, and had bought seven bags of wheat, stated at the meeting following the preliminary purchase that they had saved their £1 already. Operations soon had to be extended, as bran and pollard, kerosene, and other articles were required. The system worked well for a start, but it was soon found that a stock-in-hand was required, and an available store was rented, and a storeman engaged, as the business was becoming too extensive for voluntary labour. From this point the growth of the company was rapid, and at the end of the first year a dividend was paid on shares of 7½ per cent., and a bonus of 1s. in the £ on purchases, thus putting the society on a good footing.

The great success of this company has been in being able to supply bran and pollard in times of scarcity, for in trying to cater for the poultry farmer the directors looked ahead for supplies, and thus saved the local poultry industry. The company now supplies all the needs of poultry farmers and orchardists, including manure, lime, sprays, flour, coal, and coke. Anything else required is obtained for them.

One great result has been the reduction of prices in the district for miles around; in fact, the local profiteer has been abolished. The turnover is now nearly £3,000 per month. The capital amounts to £1,300, of which amount over £500 is accrued bonuses, so that members have only paid in £800, though holding £1,300 worth of scrip carrying 7½ per cent. interest.

Adjoining the railway siding a store has lately been built at a cost of £350, the money being allocated from last year's profits. The company now owns real estate to the value of over £800, all paid for, and instead of depending upon voluntary labour, a managing director and a storeman are employed.

This shows what can be done by co-operation on right lines, and by good management. It has not been accomplished without opposition, but the directors have gone on steadily, giving everyone a fair deal, pursuing a straight policy, and to-day the concern is a strong one and no one can trouble it.

The Two Methods Compared.

The two examples of (*a*) a bulk-buying concern operating without registration and without the formation of a company, and (*b*) a registered co-operative society, as typical, successful farmers' concerns, should prove useful models for other communities.

Just as Milbrulong has realised the advantages of taking a step forward in the movement, so has Miranda realised that it should now take its next step and affiliate with other organisations of a similar nature to secure the advantages of co-operative wholesale buying. To a certain degree this is impossible at the present juncture, because there is no co-operative agricultural wholesale society in the State. Certainly it could affiliate with the New South Wales Co-operative Wholesale Society, but this affiliation would only assist it in certain lines, inasmuch as that society is the daughter of some thirty or forty co-operative stores in more densely populated areas, and it naturally caters especially for the repuirements of the affiliated stores. Still, it is obvious that with the affiliation of numerous societies similar to those of Miranda and Milbrulong, the existing wholesale society could with mutual advantage assume the functions of a co-operative agricultural wholesale society, and farming communities as consumers could without any sacrifices easily and profitably affiliate. In fact, such a course would even be preferable to the establishment of a separate co-operative wholesale society, and the existing society is actually anxious for the affiliation of co-operative institutions in rural communities.

(*To be continued.*)

Medicinal and Culinary Herbs.

The production of medicinal and culinary herbs in a commercial scale is only recommended as a side line, and not as a sole means of livelihood. In fact, it would be extremely hazardous for one to attempt as an industry, unless he was an expert cultivator and was familiar with the state of the market, and with the preparation of the goods for market. Supplies from oversea countries of cheaper production are now becoming normal, and the growth of lavender, grasses, and various mints for their essential oils is a fickle industry, by reason of the fact that most of the oils and perfumery produced naturally are now manufactured synthetically.—E. N. Ward, Superintendeent of Gardens.

Combined Sprays.

In making combination sprays, it is essential to see that the whole quantity of liquid is correct. If 100 gallons of lead arsenate and nicotine solution are being made, the method would be somewhat as follows:—If 1 lb. arsenate of lead is being used to 25 gallons of water, it would be necessary, of course, to use 4 lb. lead arsenate, and if the concentrated nicotine solution was being included at the rate of 1 to 800 by volume (1 pint to 100 gallons water), the better plan would be to mix the lead arsenate in, say, 95 gallons of water. One pint of the nicotine concentrate should be mixed with 4 gallons 7 pints of water, and added to the 95 gallons of lead arsenate.—W. J. Allen.

Producing Lucerne Hay under Irrigation Conditions.

Methods and Experiences at Yanco Experiment Farm.

[Continued from page 471.]

F. G. CHOMLEY, Manager, and F. CHAFFEY, Farm Foreman.

The Irrigation of Lucerne.

THE lucerne being thus established, the method of irrigation during the rest of the life of the stand may engage attention.

The first application of water is given as soon as the first crop of hay is off the land, in order to stimulate an early growth, and further irrigations follow as the season requires. Generally speaking, one irrigation for each cut is sufficient in the early part of the season, but as the weather gets hotter more are necessary, averaging two per cutting, and the exact time when these are made must entirely depend on the season.

The practice at the farm is to irrigate a week before cutting. A second watering is given as soon as the hay has been taken off; this makes two waterings per cutting, which is usually sufficient. Should the weather be excessively dry and hot an extra watering about fourteen days after cutting may be found necessary. The object aimed at is to keep sufficient moisture in the soil to produce maximum results. Other periods of watering have been tried, but the above practice has been found to give the best results. It is not advisable to wait until the lucerne shows signs of distress; this must be anticipated as much as possible.

As already indicated, a big body of water is never turned on the lucerne at one time. The head ditch is filled and then a gap is opened in the bank about half-way between the check banks, allowing enough water to escape to spread from bank to bank, just covering the surface and moving forward very slowly. The slow advance of the water robs irrigation of much of its attractiveness, no doubt, but a rush of water is never satisfactory, for it wets the surface without saturating the subsoil. It should take from six to eight hours for the water to reach the lower end of the block 6 chains away, by which time the water can be shut off at the upper end. If the land has been well graded, and the water properly applied, there should be very little surplus water to fall into the drain.

The above method is that adopted on a heavy soil, of course; on lighter soils, which absorb water more rapidly, the flow can be a little faster. The land on the farm will absorb 2½ to 3 inches of water, whereas light soils with such a slow flow would take up too much. If too much water is applied the

effect is a consolidation of the surface that deprives the roots of the lucerne of air, and hinders bacterial activity in the soil.

It is imperative that facilities be provided for thorough surface drainage. Water lying on lucerne for three hours on a hot day will scald the plants and do irreparable damage to the stand. Special attention is necessary in the evening in ceasing operations to ensure no flooding. This is achieved by starting more checks, which will take the whole night to run through.

A close watch must be kept on the growth, and so soon as there is any appearance that water is required it should be applied. Farmers are inclined to consider any special irrigation as either too much work or too much expense, but if lucerne-growing is to be a success any reluctance on either of those scores or any imaginary grievance about the price of the water must be put aside. It is the commercial result that has to be kept in view,

Flooding a Lucerne Block.

Slow soakage is the method sanctioned by experience at Yanco Experiment Farm.

and water must be applied at intervals required by the crop—not at the convenience of the grower. If the water is left too late the growth seems to harden off, and can never be brought back to its original freshness; indeed, watering after the top growth has hardened off only promotes the development of the next growth from the ground, and does little for the standing crop.

The secret of success with lucerne is to watch it at all stages, to keep it growing as you would a soft green vegetable for the table, and to cut it as soon as it is ready.

The "hardening off" referred to is difficult to describe in any other term, but the observant farmer will quickly detect it. The best treatment is to turn in the water immediately that symptom appears; if done quickly enough the effect may be to save the crop and bring it back to its original

freshness. If it is impossible to water at once it will be better to proceed to harvest the crop for hay in the ordinary way, and to take greater care thereafter not to allow the crop to go so long without water. When the crop has lost its fresh, green colour and has acquired a bluish appearance, it is too late to restore it to the sappy condition that makes the best hay.

When to Cut Lucerne for Hay.

The right stage to cut the crop has always been a matter of discussion among lucerne growers. On the farm we do not watch the bloom, though many authorities advise cutting when one-tenth of the heads are in flower. We prefer to watch the bottom of the growth. So soon as the lower leaves have turned a lightish colour, and the new shoots begin to appear on the crown, the crop is ready to be cut. The operation must not be delayed, for the leaves, in which much of the nutrition and palatability of the hay are stored, will then fall off, and the hay will be harsh and stalky. The dropping of these leaves is the provision that nature makes for the admission

Lucerne Ready for the Mower.

Six to seven cuts per season, each yielding one ton of hay per acre, are obtained on the best land at Yanco Experiment Farm.

of light and air to the young shoots that are appearing on the crown, so that nature, as well as commercial interest, indicates to the farmer when he should cut.

The early cuttings of each season take about six weeks to grow, but as midsummer comes on the lucerne grows quicker and quicker, and in January, February, and March, and even in April, only four weeks are required to mature a cut. As the weather cools off, the growth becomes slower again, and the last cut usually requires six weeks. On this basis is is possible to get six or seven cuts in a year, and, owing to the regular water that irrigation ensures, there is more certainty of the seven cuts in a dry hot season than in a wet one. As a matter of fact, the competent farmer has his fortune in his own hands under irrigation in a manner that is impossible under any other conditions; not only is this true in respect of

quantity, but it applies to quality also. However sound his methods may be, the Tamworth or Hunter River grower of lucerne hay stands no small risk of two or three crops of indifferent quality per season, but crediting the Yanco grower with every likely mischance he should produce six crops of good quality hay every season, and perhaps a partially spoiled one to boot.

Modern Machinery for Haymaking and Marketing.

With the aid of thoroughly up-to-date machinery, lucerne hay making on this farm has become a regular routine. The financial outlay has perhaps been greater than a small grower would care to contemplate, but it has been no greater than might reasonably be undertaken by any grower or group of growers who could see their way to handling, say, 100 acres under lucerne. It may even be hazarded that the time is not so distant when the

The Mower in a Good Crop.

whole operation of cutting, curing, carting, and baling, will be undertaken on contract by the owner of a plant that involves a good deal less money than the threshing mill and engine so common in our cooler grain districts.

Briefly, the hay is cut with an ordinary mower, drawn into windrows with a rotary rake, picked up by a hay loader, carted direct to a derrick press, baled and wired without the formality of being stacked, and drawn at once to the railway. From waving lucerne in the paddock to fragrant hay on the truck something less than three days is involved in the height of the season, and a team of eight men, including the foreman, keep pace with the growth of 120 acres.

But we retrace our steps to give the process in more detail.

The crop being ready in accordance with the indications described above, it is cut with the mower, and allowed to lie in the swath until it has wilted nicely. The mower should be set to cut as low as possible without the

blades being damaged, the object being twofold, namely, to get the maximum of hay, and to force the new growth from the crown proper, rather than from the bottom nodes of the cut stalks. No swath board is used; and this is important, as a swath board gathers the lucerne into a row which does not dry evenly. In the early part of the season drying in the swath may take three days, but in the height of midsummer a few hours is all that is required, the morning cut being often ready to be drawn into windrows in the afternoon. In the cool weather and damp nights of the spring and autumn the windrow may require to be turned once, but in the summer the handling must be the minimum or the leaves will be lost, and with them much of the quality and attractiveness of the hay.

The rotary rake does its work expeditiously and well, leaving the windrows loose and light, so that the air passes freely through the stuff, drying it as rapidly as if it were in the best-made cock.

The time of carting is influenced by the same considerations. The condition of the hay is the true indication as to when it is ready to be picked up; it should not be left to become dry or brittle, and it should be tough in the hand though without sap when twisted. It is one of the advantages of having irrigated shortly before cutting, that the ground is not devoid of moisture, and should the hay become a little too brittle for safe carting in the afternoon it can be left on the ground, and will take up moisture again at night; in that condition it is less likely to drop its leaves, and can often be carted quite safely in the morning.

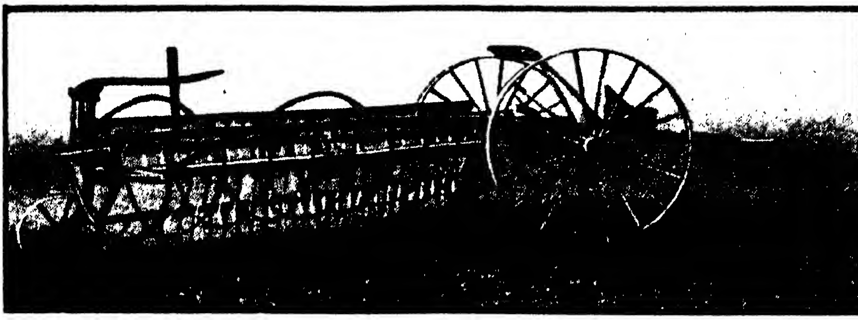
From the windrow the mechanical loader lifts the hay direct on to the waggon in an unbroken swath. No second raking, no laborious cocking, no heavy forking to the top of the load—only that steady ascending stream of green stuff picked up by two sets of small rotating forks, and carried by a simple elevator to the top of the load. Three men make up the loading gang, one being in charge of the horses and the other two stacking the hay on the waggon.

The crop being off the ground, the next growth comes away readily, and (assisted by irrigation as required) in the height of summer is ready to cut in four weeks. Let it be said that irrigation in view of each cut necessarily depends on the weather, for if rain falls in sufficient quantities it may not be necessary to turn the water on during growth, but the least appearance of the "hardening" already described should be the signal that a watering is necessary.

On page 467 last month the board of the road-grader was described as 19 feet long. This should have been 10 feet.

(*To be continued*).

Correction.—The omission of a title, "Hay Yields," at the top of page 406 in the June issue of this *Gazette*, made the article read as though no grain yields were taken. As the previous page showed, the grain yields were recorded. It was the hay yields that were not taken.



The Rotary Hay Rake.

The Rotary Hay Rake at Work.

This implement draws the hay into windrows in which it dries and cures as well as in the best made haycock.

The Hay Loader in the Field.

The lucerne hay is lifted from the windrow and carried in a steady stream up the elevator as the waggon moves forward.

Hope of Wollongbar (280. Vol. II, A.G.H.B.), by Hayes' Fido (imp. 24 A.G.H.B.), ex Faith (48 A.G.H.B.).

Official Test—13,417 lb. milk 800·017 lb. butter-fat, in 365 days.

High Milk and Butter-fat Production.

THE PURE-BRED GUERNSEY COW—HOPE OF WOLLONGBAR.

L. T. MACINNES, Dairy Expert.

ANOTHER meritorious performance has been completed under the official tests carried out by the Department of Agriculture—this time by the Guernsey cow, Hope of Wollongbar, bred and owned by the Department of Agriculture, New South Wales, and milked on the Wollongbar Experiment Farm, Lismore, where the Department's Guernsey herd is located.

Since the United Pure Bred Dairy Cattle Breeders' Association of New South Wales, of which the Department is a member, commenced submitting stud dams for official test, it has been the means of bringing before the public in all parts of the world the splendid capabilities of New South Wales dairy stock of all breeds. The high yields of milk and butter-fat given by large numbers of our stud stock are attracting wide attention, not only in Australia, but in New Zealand, South Africa, North America, and Great Britain. A few years ago a yield of over 400 lb. butter-fat was considered worthy of comment, now such records are common, and it requires something well over 500 lb. to attract notice, and for a special paragraph it needs to be something over 600 lb. butter-fat.

The great improvement shown has been brought about by better breeding. The stud masters in charge of herds under official test are using sires that are of proved high production strain, irrespective to a great extent of their merits from a show-ring point of view; as long as they have also a strong constitution and physical development on the lines needed to make up any deficiency in that way in the strain with which they are being mated.

Another most important factor bearing on improved yields is the better methods of feeding that are being adopted. Formerly it was too often apparent that cows were being subjected to a production trial without being supplied with sufficient food to sustain themselves. But once breeders get interested in their production records, they soon set about rectifying this. They grow fodder crops to aid the pastures, and study the individual constitutions of their cows and ration them accordingly, giving concentrated foods, such as maize, oats, linseed meals, oil cake, bran, etc., in the proportions suitable for each case. As soon as the fluctuations in the cows' production can be studied by means of the test sheet, it does not take long to discover that, while a given ration may induce an increase in yield in one cow, it may not have the same effect on its mate, and something different has to be tried. Undoubtedly there are numbers of pure-bred cows in the State that would, if properly fed, give much higher yields than they do, without detriment to their health and to the benefit of their owners' bank accounts. The idea that it is unprofitable to hand-feed a cow in addition to what she picks up in the fields, is untenable as a general statement. Some, certainly, as dairy animals

are not worth feeding (some not even by pasturing), but in the great majority of cases the increased yields very much more than pay for the added cost of the extra fodder. Unfortunately, most of our stud cows are not given a chance to prove themselves ; their owners, either through fear, ignorance or lack of progressiveness, take no steps to put them under test, in order to clear their reputations.

The Record of Hope of Wollongbar (280, Vol. II, A.G.H.B.)

The present is not the only test on record as regards Hope of Wollongbar. She has three other records for lactation periods of 273 days each to her credit, but the last, the fourth, was the only one conducted under really favourable feeding conditions. The various yields given during the last four years exemplify the beneficial results of feeding, and also the loss entailed in not providing full and plenty for a cow at all times, including the months prior to freshening. To do justice to herself an animal should not be in poor condition when she calves. On the last trial Hope of Wollongbar's average test was increased, showing that during previous lactation periods she had not been producing to her full capacity, either as to quantity of milk or of fat content. Ill feed or illtreat a cow, and the result is shown in the reduced test, as well as in a lessened flow of milk. It remains to be seen if Hope has yet reached her maximum. She was not under a proper ration during the last test, and if that were given next time she might exceed her present average test, high though it is. No cow can exceed her maximum, but to ascertain what is her maximum requires scientific feeding, and kind, careful treatment. In striving for the maximum, however, the constitution should not be overtaxed, nor the capacity for breeding endangered.

HOPE OF WOLLONGBAR'S Milk and Butter-fat Records—273 days.

Test.	Age.	Commenced Test.	Milk Yield.	Butter-fat.	Average Test.	Commercial Butter.
	yrs. mths.		lb.	lb.	per cent.	lb.
1st ...	2 9 ...	2 October, 1916 ...	3,790	200·000	5·3	241
2nd ...	4 0 ...	3 January, 1918 ...	5,799	324·381	5·6	378
3rd ...	5 4 ...	1 June, 1919 ...	8,311½	461·895	5·6	556
4th ...	6 6 ...	5 July, 1920 ...	11,214	655·017	5·8	789

The last test was continued to cover 365 days, at the end of which time the record was 13,417 lb. milk, 800·017 lb. butter-fat, average test 6·0 per cent., which, upon the standard adopted by the Breeders' Association of 83 lb. of butter-fat to each 100 lb. of commercial butter, means equal to 963·875 lb. commercial butter. The records were calculated under Scale B (regulations governing the official herd-testing scheme), which provides :—"In the cases of cows tested fifteen to twenty-four days, both inclusive, after calving, that the actual tests made at the time of the tester's visit if not abnormal shall be used without averaging with either the preceding or succeeding tests as the base of calculation of each sub-period of the test. The whole period to be covered by nine or twelve tests as required to complete 273 or 365 days respectively."

Hope of Wollongbar began her test on 5th July, 1920, and the last or twelfth test was made on 30th May, 1921. She calved on 19th June, 1920, and the period of the test commenced four clear days afterwards, in accordance with the Association's rules. The last test was therefore made on the 341st day after the test began, or fourteen days prior to the end of the testing period (365 days). She was dried off on the 14th June. On her final test she gave in the morning 9 lb. milk testing 6·1 per cent., and in the evening 7 lb. milk testing 6·8 per cent.—equal to 16 lb. milk, 1·025 lb. butter-fat for the twenty-four hours, or 496 lb. milk, 31·775 lb. butter for the twelfth sub-period of thirty-one days.

On the first test she gave 43 lb. milk, 2·639 lb. fat; the best yield of the whole period was given in December on the sixth test, when she produced 43½ lb. milk, 2·748 lb. fat. She was milked twice daily and received no special attention. She was rugged in the winter and at all times lived in the open, not being housed at night. She was served on 5th November, 1920, shortly after the test commenced, and carried a calf for about seven and a half months of the lactation period.

Hope of Wollongbar's Pedigree.

The following are the particulars of this cow's breeding:—

Calved 10th January, 1914.
Bred by and the property of New South Wales Department of Agriculture.
Sire, Hayes' Fido (imp., 24 A.G.H.B.).
Dam, Faith (48 A.G.H.B.).
Sire of dam, Prince Souvia by Vivid's Prince by Rose Prince (imp.).
Second dam, Miss Clatford of Wollongbar (124) (imp. in dam).
Sire of second dam, Clatford Hope II, (28) (1814 E.G.H.B.).
Third dam, Clatford Hopeful (27) (imp. 6811, E.G.H.B.).
Sire of third dam, His Majesty III, (1387 P.S.R.G.A.S.).
Fourth dam, Lady Tucker (5733 P.S.R.G.A.S.) by Flying Fish (303 F.S.R.G.A.S.).

Although known to come of a producing family, the records are not available to the same extent as in the case of the Milking Shorthorn cow Melba XV, described in June, but various relatives have been tested officially in this State under the United Breeders' Association's scheme, and these give some indication of the hereditary production running in the strain.

Her dam Faith, at 6 years old, gave 3,894 lb. milk, 246 lb. butter, in 213 days. This record was put up under unusual circumstances, when Faith was on her fifth calf. She came in after the birth of her first calf with her udder injured, and she lost two quarters permanently. She was not at first milked by hand, but until a start was made to milk her for the above record she was used solely to suckle calves. The record, therefore, demonstrates what she was capable of producing with two teats only.

Vivid, the g.g.g. dam of Hope, gave 4,679 lb. milk, 220 lb. fat, in 189 days.

Of the dam of Hayes' Fido (Hope's sire), there is no record, but Hayes' Olive (imp.), the dam of Hayes' Fido's sire (Hayes' Coronation III) has several records entered to her name in the English Guernsey Herd Book, as winner of both milk and butter-fat tests at the London Dairy Show and

elsewhere. These records are of much less value than those showing production over lengthy periods, such as nine or twelve months, but they serve to indicate that there was a production trait in the strain. Hope is third in descent from Hayes' Olive.

Hope's Own Progeny.

Of her own progeny, two have been tested to date—her twin daughters Honour and Trust. Their records were put up off pastures alone.

	Age.	Milk. lb.	Butter-fat. lb.	Period.
Honour ...	3½ years	5,446½	305	273 days.
Trust ...	3½ ,,	5,763	277	273 ,,

Honour has commenced her third testing period, and promises to put up a record worthy of her dam. Trust is springing to her third calf.

Hope's son, Judge of Wollongbar, was exhibited in the yearling class at the Royal Agricultural Society's Show this year and won the blue ribbon.

The Wollongbar Guernsey Herd.

This herd, of which Hope of Wollongbar is a unit, is a very fine one, second to none of the breed in Australia. Not only has the Herdmaster of the Department, Mr. J. A. Robertson, built up the constitution and improved the type, but production, that most important character in dairying, has received special attention. As an example of what has been done from the standpoint of general appearance, it may be stated that the champion bull at the last Sydney Royal Show was Rose Chief of Wollongbar, and, as already stated, the first in yearling bulls also went to the same stud.

As regards production, many individual fine records have been made in addition to the one now under review, but the improvement that has taken place is best exemplified by the increase in the average production of the herd. In 1913 the average was 206 lb. of butter; for 1917-18 it was 278 lb.; for 1918-19 it was 332 lb.; for 1919-20 (a drought year) it was 375 lb.; and for the year ending 30th June, 1921, it reached 385 lb. The average number in the milking herd during the latter two years was about forty-five. This is a very fine average, and reflects great credit on the manager of the farm, Mr. A. H. Haywood, and his assistants, apart from the fine demonstration it gives of the soundness of the lines on which the stock are being bred by the Herdmaster.

Hope's Feed and Rations.

The following are the particulars of Hope of Wollongbar's feed during the test:—

Pastures.—Paspalum, also clover (October).

Rations.—July to September: A small quantity of ensilage and bran; October: about 10 lb. bran and chaff daily, also ensilage; November: 6 lb. bran, 6 lb. lucerne chaff, and 6 lb. oaten chaff daily; December: about 15 lb. lucerne chaff, bran, linseed meal, and wheaten chaff daily; January: about 20 lb. bran and chaff and chaffed green corn daily; February: about 15 lb. bran, lucerne, and oaten chaff daily; March: about 16 lb. bran, chaff, and chaffed milky corn cobs twice daily; April: 4 lb. bran, 4 lb. lucerne chaff, and 2 lb. crushed oats at each milking; May: 10 lb. lucerne chaff and bran daily.

The Cause of Black Disease and its Method of Transmission.

Being Further Studies in a Braxy-like Disease of Sheep.

[Continued from page 511.]

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The Natural Method of Infection.

Before entering upon a discussion as to the natural method of infection in black disease, it may first be advisable to note some points that have been observed clinically and experimentally in connection with this condition, most of which are already recorded in this and my previous article.

Clinical.—The disease is seasonal, the vast majority of cases occurring from late summer to early winter. In mild seasons occasional deaths will take place throughout the winter. On infected properties, sheep grazing in paddocks well watered by springs but in which the ground is not well drained or which contain swampy areas, not necessarily of very large extent, are subject to a heavy annual mortality from black disease, except in seasons of unusual dryness when the moist places have dried up, whereas sheep kept in paddocks having water from the same sources running through them, but where the ground is well drained naturally, show few losses or none at all. The division between the infected and non-infected paddocks may be merely a wire fence or a stone wall. In infected paddocks that have been artificially drained the mortality has been considerably diminished. In a very dry season, such as that experienced in 1918-19, the death-rate in paddocks known to be heavily infected was unusually light.

There is no evidence of any kind to show that the disease can be communicated directly from one animal to another. It is stated that after the transfer of the whole of an affected flock to a clean paddock a few cases occur for a short time, and then the mortality ceases. These are apparently cases of infection, or rather (as will be shown) of potential infection before removal. Owners have informed me that no cases occur in a subsequent season in a clean paddock (that is, paddocks in which black disease has never been known to occur) to which an affected flock has been removed, but of this latter I have no direct evidence. All the evidence goes to show that the causal organism of black disease is a facultative parasite, and that the places most dangerous for sheep are the springs and moist, undrained areas in the paddocks. The disease appears peculiar to the sheep, for other animals grazing over the same country remain unaffected. Popular opinion considers that the springs and moist places are

the localities whence the disease arises, although the view is that it is due to eating plants growing therein, *e.g.*, watercress. Fluke disease of the liver is very common among all sheep in the area in which black disease is known to occur. Some sheepowners have observed the coincident occurrence of black disease and fluke infestation. This has led a few of them to express the opinion that the former is nothing else but acute fluke disease of the liver. That this is not the case is shown by the fact that fluke disease is common in numerous parts of New South Wales and elsewhere, but black disease or anything resembling it is unknown in many such places.

Experimental.—It has been demonstrated that the administration of large amounts of virulent sporing bacilli by the alimentary tract fails to set up any sign of infection. Consequently the mere ingestion of contaminated water or food can hardly be considered to be the usual method of natural infection. The same deduction may be drawn from the feeding experiments made with minced organs and viscera, &c., from animals dead from natural infection. The subcutaneous inoculation of small amounts of culture are very fatal to susceptible animals, and always gives rise to definite changes at and around the site of inoculation. Mere scarification is insufficient to infect. Seeing that in naturally-occurring cases no cutaneous or muscular lesion is encountered in animals examined immediately they are dead (if one excepts the occasional presence of a clear intermuscular or subcutaneous exudate in certain situations), it is quite reasonable to conclude that the common natural method of infection is not through the skin. The same reasoning may be advanced against the view that the bacilli gain entrance to the body by means of small abrasions of the mucosa of the alimentary tract, including the abomasum. Infection by inhalation may be dismissed as the least probable method of any.

Another important feature of the disease is that of the hepatic lesion or lesions. If this is, as I consider it to be, the primary lesion in black disease, the question at once arises, how does it originate? The writer has made post-mortem examinations on many hundreds of sheep at various times and places, but has not seen these particular hepatic lesions in any condition other than black disease, although focal necrosis of the liver may be caused by other agents. Seeing that experimentally-ingested bacilli fail to infect, one naturally seeks an explanation as to the means whereby the bacilli reach the liver and produce the special lesions therein. After weighing the arguments presenting themselves, I have arrived at the conclusion that the solution of the problem of the natural method of infection and the situation of the primary lesion in the liver is to be found in the liver fluke. If the feasibility of such a hypothesis be accepted, then almost all of the features concerning the transmission of black disease become fairly clear.

The factors that have been found to coincide with the prevalence of black disease are just those which prevail in connection with the presence of recent fluke infestation. Drainage of marshy areas around and along

the course of springs and watercourses, where carried out effectively, has often been succeeded the following season by a greatly diminished mortality from black disease. In fact, before I had demonstrated the cause of the disease, I consistently recommended this plan. When owners now seek advice regarding this condition I generally inform them that if they get rid of the liver fluke they need not trouble very much about black disease. This advice, when followed out by draining the infected places, has at times had a not unexpected result, because paddocks where it was almost certain one could get material in the shape of affected sheep during the season for research work, have now become useless for investigations, as few cases are seen in them, and these at only irregular periods.

Drainage, as is well known, assists in keeping down fluke disease by decreasing the number of water snails (the intermediate host of the fluke), and providing an unfavourable nidus for the fluke embryos, &c. An instance of the foregoing may be cited. A certain paddock running about 2,000 sheep has been notorious for black disease for the past twenty-six years, the average annual loss in it from this condition being about 25 to 30 per cent. The paddock contains several springs and the ground in their neighbourhood was swampy. Up to the end of 1918 fluke disease in this paddock was very prevalent. At the end of that year the paddock was well drained. The season of 1918-19 was very dry. During that year the paddock carried about 1,000 sheep. The mortality from black disease was about 3 per cent. In another paddock, running about 2,000 to 3,000 sheep, where also the previous annual losses from this disease had been considerable, the same conditions obtained in 1918-19 as on the area just mentioned, viz., drainage of the swampy spots and dry season. The percentage mortality from black disease was lowered to about the same as in the previous instance. In both cases the sheep during that season had been under closer observation than usual.

Seeing that the causal organism is a sporing, and in every probability a facultative, parasite, it is not probable that it could have died out in these paddocks in such a short period. The explanation appears rather to be that the intermediate host of the liver fluke, viz., the water snail, had become considerably reduced in numbers, or had migrated to more congenial localities not grazed over by the sheep, and also that many of the fluke embryos, not finding their host, had also died, the consequence being less fluke invasion of the liver of the sheep in these paddocks and less black disease.

In connecting the fluke with the transmission of black disease it is noteworthy that in all undoubted cases of that condition there has been fluke infestation of the liver; in some cases, however, only slight, and the invasion has been recent. The animals have all been in good condition. I have never seen a case of black disease in which the fluke disease was very advanced. This indicates that infection occurs very shortly after the carrier fluke gains admission to the liver, and agrees with experimental evidence, the latter showing that the condition is not a chronic one and that the period of incubation is not a matter of several days. In natural cases the period of incubation, of course, would not commence until the bacilli

had been lodged in the liver. A greater or fewer number of flukes may reach the liver prior to the advent of the carrier, for it is not suggested that every fluke is an actual carrier of infection, although it is a potential one. This is shown by the fact that a large percentage of sheep on infected country, dead from causes other than black disease, have fluke-infested livers. As a matter of fact, it is possible that relatively few of the total number of fluke parasites reaching the liver carry with them the causal organism of black disease, seeing that the necrotic foci in the liver, which are the primary lesions, are usually so few in number. There may be only one such lesion. In view of the relatively small number of bacilli required to infect artificially, the great number of those present in a single hepatic lesion would be quite adequate to account for the symptoms and death in naturally-infected cases. In the few instances where careful search has failed to reveal a definite local lesion in the liver, but where bacteriological or experimental investigation has shown the bacteria to be present in that organ, it is suggested that such are cases of mass infection, the defences of the organ and the body in general having been overwhelmed before any reaction—that is, a local lesion—has had time to become visible to the naked eye. In the early days of the investigations (1914-15) the liver was not specially examined by making numerous incisions for these necrotic foci, and no doubt those situated in the depths of the organ escaped observation during the usual routine post-mortem examination. When, however, it was found that the absence of these particular lesions was more unusual than their presence, special attention was paid to the liver.

In connection with fluke invasion itself, it has been noted by other observers that bacteria (for example, *B. coli*) have been mechanically conveyed to the liver from the intestinal tract by that parasite.

In discussing the role of the liver fluke in the transmission of black disease, there is no doubt that the causal organism of the latter is numerously present in certain paddocks, probably scattered over the whole surface by dead black-disease sheep allowed to rot where they die and other agencies, but, being a facultative parasite, one would reasonably expect it to be more abundant in the situations more favourable to its saprophytic mode of existence, viz., in moist localities. It may be accepted that sheep in such paddocks will swallow varying amounts of the bacilli in question with their food and water, although such animals drink little water when food is succulent. Yet, as has been experimentally demonstrated, the mere ingestion of large amounts of virulent bacilli is insufficient to infect. As already noted, *Fasciola hepaticum* is very prevalent in the affected paddocks. Whether the immature fluke (cercaria) becomes contaminated whilst on the ground, or whether it becomes so during its passage through the anterior part of the alimentary tract, is a matter for speculation, but there is no improbability in the latter.

A feature of the experimentally-induced disease is that if minimal lethal doses of bacilli be injected, its course may be prolonged a day or so, and the lesion at the point of inoculation is more pronounced. One can thus understand that if the number of bacilli introduced into the liver by the

fluke is insufficient to overwhelm the defences of that organ, there is time for a reaction on the part of the latter to occur, and for a definite local lesion to become evident to the naked eye. That such a reaction on the part of liver tissue does take place as a rule is evidenced by histological examination. The result is that the bacilli are confined to the lesion and no systemic invasion ensues, the general symptoms and lesions elsewhere no doubt being due to an endo-toxin.

The seasonal occurrence of black disease may be explained by taking into account the habits of sheep and the life history of the liver fluke. Fluke infestation of animals is generally considered to occur mainly in spring and autumn, although it may take place at any time. In the spring there is little need for sheep as a whole to graze over the marshy places, which are relatively small in area, in an infected paddock, as the animals drink little water then, and the herbage elsewhere is, in general, succulent. In spring and summer, therefore, the probability of the causal organism being conveyed to the liver by the immigrating flukes is not so pronounced. The disease first becomes noticeable in summer. At first the death rate is light, but as the season advances the mortality gradually increases until in late autumn it reaches its height, coinciding with the period at which the migration of flukes to the liver is also at its maximum. The onset of severe frost is generally considered to put a stop to the ravages of the disease for that season, but if the weather be mild, deaths take place throughout the winter. In some places where the winters are not so severe it is stated that black disease may be seen at any time of the year. This latter statement, however, is not to be accepted without reservation, for sometimes any death of sheep is ascribed to black disease merely because the animals have been found dead, no attempts at post-mortem examination having been made. Furthermore, I have known men confidently say that they have known sheep to die from black disease in their district, although they will admit that they have never examined a case of that disease.

In the districts where the disease in enzoötic, the cessation or continuance of infection may be explained if one considers the effects of frosts on fluke embryos and cercariæ. Numbers of the former (not all, by any means) will be killed off, thus lessening the number of cercariæ to be swallowed by the sheep, and consequently the chances of infection by the black disease bacillus also, until next season. Furthermore, provided there is food elsewhere, there is no inducement for sheep to frequent wet places in the winter.

It hardly needs stating that if the causal organism is not present either contaminating the soil, or mixed with the stomach contents of the sheep, no amount of fluke invasion will produce black disease.

Another interesting feature—perhaps unimportant in itself, but forming one of the links in the chain of evidence—is that for several years past the seasons in general have been on the whole dry, and several large sheepowners have informed me that during the past few years black disease has by no means been so prevalent on their stations as in former years.

Although it may be admitted that the evidence put forward to incriminate the liver fluke in its migration from the exterior of the body to the liver of the infected sheep, as being the mechanical agent in the transmission of the causal organism of black disease is largely circumstantial, yet this explanation of the natural method of infection and the situation of the primary lesion or lesions appears more satisfactory than any other advanced so far.

(*To be continued.*)

School Children's Maize Growing Competition at Yanco.

In order to stimulate interest in the growing of crops, and in agriculture generally, among children on the Murrumbidgee Irrigation Areas, a maize-growing competition was held last year under the auspices of the local Agricultural Society. Seed of nineteen of the earlier maturing varieties was provided by the Department of Agriculture, in sufficient quantity for the sowing of one-tenth of an acre of each, and through the generosity of Dr. Vance, who donated ten guineas as prize money, the Society included the competition in the schedule of prizes at its show. It was anticipated that the exhibits would have been available at the time of the show, but, owing to some of the varieties not being sufficiently matured, it was eventually decided to postpone the judging.

The competition was divided into two sections, one at the Leeton School, under the supervision of Mr. M. R. McGee, and the other at Brobenah School, under the control of Mr. S. C. Small. The prizes were offered for the best dozen cobs, and 5 lb. of shelled maize, to be grown by a school child on the home farm, the conditions requiring that the grower should carry out all cultural operations and irrigations, and keep and exhibit a complete set of notes of these, as well as of the characteristics and habits of the particular variety under trial.

Twelve pupils took up plots at Leeton, and seven at Brobenah, but, owing to accidents to the growing crops through straying stock, every grower did not exhibit. The season was very favourable for maize growing, and some very good exhibits were put before Mr. A. N. Shepherd, Inspector of Agriculture, to whom the Minister granted permission to act as judge. At both schools the winning exhibit was of the Silvermine variety, though at Leeton Funk's Yellow Dent came a very close second. The score card was used in judging, so that each competitor was enabled to see why his exhibit gained or lost points on those of the others. The prize-winners were as follows:—Leeton School: F. Wood, 1st; J. Tiffen, 2nd. Brobenah School: Jean Evans, 1st; B. Smith, 2nd. Champion prize, Jean Evans.

Mr. McGee, who has been appointed by the Education Department, Instructor of Agriculture to the schools of the area, now has in hand a hay-growing trial, in which some sixty pupils are participating, and taking great interest. Such competitions cannot fail to serve the cause of progressive farming in this district in a very valuable degree.

Advice to Intending Growers of Bananas.

W. J. ALLEN and R. G. BARTLETT.

DURING the past few years many have entered the ranks of banana growers without any previous knowledge, making numerous initial mistakes that could have been avoided if they had been in possession of a few essentials of the business. It is with the object of enabling others to avoid those errors, and so saving them from the expensive method of learning by their mistakes that the following advice and information are given.

It may be said that in New South Wales the A B C of selecting land for a banana plantation consists of A. (shelter), B (soil), C (aspect), and a few hints under each heading may be useful.

Shelter.

The value of shelter from southerly and westerly winds cannot be too strongly stressed, for it is a most important factor in the future productivity and permanence of a plantation. Too little attention is given to shelter; bananas are sometimes planted on exposed hillsides, and consequently only moderate results are obtained, and the reason is not far to seek.

Almost the whole of the banana plant is composed of leaf matter. The broad undivided leaf of the plant shows that its natural habitat must have been in sheltered regions, where the leaves would be protected from boisterous winds. Hence it may be inferred that a windy situation is not suitable if large bunches and well developed fruit are desired. The function of the leaf is to obtain from the atmosphere food for the growth of the plant, the motive power for the work of manufacturing the food being obtained from the rays of the sun by means of the green colouring matter (chlorophyll). The water absorbed by the roots, together with the mineral plant foods in solution, is carried to the leaves, and there with the carbonic acid gas of the air, the various organic compounds are elaborated by the plant. The compounds so manufactured are then transferred, and used where required or are stored up in the bulb for future use.

This consideration of the importance of leaf functions shows sufficiently that heavy winds, by cutting the leaves into ribbons, interfere with the manufacture of the food. Shelter is therefore necessary for the proper feeding of the plant; in fact, given good shelter a grower will get better returns from soil that is not so good than from better soil exposed to either westerly or southerly winds. For banana-growing purposes, good shelter increases the land at least 50 per cent., that is to say, land with good shelter is worth twice as much as similar land which is exposed to prevailing winds. Indeed, the chances of success without adequate shelter are remote.

Soil.

The soil most suitable for the cultivation of the banana is a deep free loam, rich in vegetable matter. Good rich scrub land is the most desirable, if it can possibly be obtained, but unfortunately the available area of scrub land suitable for bananas is rapidly diminishing, and it will soon be very difficult to obtain good scrub. Bananas require the best of land, as they take more out of the soil in a given time than any other crop, and seem to require a good deal of potash. Red volcanic soils are most in favour with successful growers, who do not mind if there is a liberal sprinkling of basaltic boulders on the surface.

The formidable appearance of the dense growth of timber on virgin scrub land frequently causes the uninitiated to select places that have been cleared of timber, but they forget the subsequent upkeep of the land that is entailed in such cases in the way of manuring and destruction of weeds. Those who know, and wish to get the best returns for their investment and labour, will select virgin land for preference. There are many reasons for this: for instance, scrub land is neither so costly nor so difficult to prepare and to plant with bananas, as is popularly supposed; it has all its future before it, has not been impoverished by previous crops, and may not require so much manuring.

Virgin soil has not been a storehouse for every weed detested by the farmer, and a careful grower can easily keep it clean, with a consequent reduction of the cost of annual upkeep. With new land the grower will know the history of his plantation, and by careful selection of plants and rigid inspection by Government inspectors, may reasonably expect his plantation to remain free from diseases.

Scrub land (and this is the most important point) undoubtedly produces more bunches and better fruit than any other class of land, and therefore the returns are greater and the margin of profit accordingly. In fact, if this type of land could be found, it is not too much to say that it should be given the preference over all else. However, as virgin scrub is becoming so conspicuous by its absence, attention is being given to lantana land and grass land, and large areas of both have been, and are being, utilised for banana plantations.

Land that has been covered with lantana for a few years can be recommended when scrub is not available. The deposits of leaves, twigs, &c., when decayed, greatly enrich the soil, and the roots bring up plant food from lower levels than those reached by the previous crop. Banana growers nowadays regard lantana as one of the best soil renovators, and not as a pest. This class of land simply requires brushing and burning off, after which the roots are grubbed out with a mattock, and the ground is ready for planting.

Grass land, now that banana growing is proving so profitable, is also receiving attention, and considerable areas are being converted into banana plantations. In this case care must be taken to see that the grass land has

originally been heavy scrub. It should be ploughed lightly with a disc to kill the grass, and then given two thorough good ploughings to stir and break up the soil. To sweeten it after the grass crop, it is necessary to use a dressing of agricultural lime (half a ton to one ton to the acre) before the final ploughing. If this is done, fairly good results will be obtained for a number of years, though artificial manuring will have to be resorted to sooner or later to keep up the production.

Aspect.

The aspect of the land has an important bearing on the production of the banana farm. During the winter the plantation is semi-dormant, and needs as much sun as it can possibly get. As "the morning sun is the growing sun," it can readily be seen that the best aspect for the plantation is northerly to north-easterly.

A site near the sea, or with a direct air line to the sea, often produces the best fruit, and apparently proximity to the sea is almost essential to ideal conditions.

Diseases in Tomato Seedlings.

Leaf-spot and blight were prevalent in some districts last year. Two or three parcels of seedlings have already been received (11th July) attacked by these diseases. Both diseases are of fungus origin, the former being caused by *Septoria lycopersici*, and the latter by *Phytophthora* sp.

Leaf-spot is recognised by pale or ochre-coloured spots, on which are produced numerous minute black bodies which contain the spores. Affected leaves have a tendency to curl. Seedlings attacked by blight are generally invaded on some part of the stem; in the majority of cases at or near the ground-line. The plants fall over and wilt. Both diseases spread rapidly, and prompt action should be taken to arrest either on its appearance.

The following measures for control are recommended :—

1. Remove and burn all diseased plants.
2. Spray the remainder with Bordeaux mixture in the proportion of 1 lb. of copper sulphate and 1 lb. of freshly burnt lime to 10 gallons of water*. Should wet weather prevail, other sprayings may be necessary at intervals of about ten days.
3. Avoid keeping the seed-bed too moist.
4. Water the soil rather than the plants.
5. Shelter the beds with some impervious material during wet weather.

—G. P. Darnell-Smith.

When lopping a tree, it must be borne in mind that the larger and older the tree the greater the shock it will suffer if large branches are cut off; it is better, therefore, to commence with a light pruning, and on no account to cut the branches off near the trunk. As a general rule the right time to prune or lop is in the winter, but the exact time is indicated by the tree being at rest, a state indicated by the fact that none of the foliage is bursting into young leaf.—J. H. Maiden.

* A circular on the preparation of Bordeaux mixture can be had on application to the Under Secretary and Director, Department of Agriculture.

Harvest Report.

GLEN INNES EXPERIMENT FARM.

R. H. GENNYS, Manager.

THE past season was a good one generally, though wind and heavy rain knocked down some 30 acres of Algerian oats and Haynes' Blue Stem wheat. The other crops stood up to it well, though from 5 feet to 7 feet high. The larger portion of the crops was sown fairly early, and these areas were free from disease and the grain was of good quality. In the later sown areas, comprising sowings of Florence and Thew wheats, and Algerian and White Tartarian oats, there was some rust, and Thew failed badly with only about half the yield of Florence, though grown beside it under similar conditions. A spell of dry weather at a critical time also interfered with the late sown crops, except Florence, which was little affected thereby. The hay yields, which are still in stack, can only be estimated, but 44 acres of Genoa, Marquis, and Haynes' Blue Stem wheats, and 4 acres of Sunrise oats, yielded very heavily (about 4 tons to the acre), while Algerian, the only variety of oats, other than Sunrise, that was cut for hay, should go about 2½ tons, its average being cut down by the late portion of the crop being short. In the manurial experiments, however, this prolific variety yielded 79 bushels to the acre in the complete manure plots, while half an acre of Florence wheat in the rotation experiments yielded at the rate of over 41 bushels to the acre. The last mentioned crop was sown with red clover, which has grown splendidly since the wheat was harvested.

The yields of the commercial areas are not strictly comparable, as they were sown at various times and in different paddocks, the oats getting the worst of the season, as they were chiefly in the later sowings and met more adverse conditions.

YIELDS of Wheat Varieties.

Variety.	Total area.	Yield per acre.
	acres.	bush. lb.
Florence	70¼	34 0
Genoa	35¾	35 48
Marquis	18	28 15
Thew	18	16 3

A total area of 142¼ acres yielded 4,479 bushels, or an average of 31 bushels per acre. In all varieties the grain was of good quality, except Thew, which was pinched.

YIELDS of Oats Varieties.

Variety.	Total area.	Yield per acre.
	acres.	bush. lb.
Sunrise	14	47 11
Ruakura	2	44 11
Algerian	17	39 17
White Tartarian	7	25 33

White Tartarian met with the worst weather conditions.

Some Germination Tests of Prickly Pear Seeds.

E. BREAKWELL, B.A., B.Sc., Agrostologist.

IN order to put the germinating qualities of prickly pear seed to the most thorough test possible, a series of experiments was initiated in 1917 by which seeds, some first subjected to various treatments, were placed under observation in the Department's seed-testing laboratory and their behaviour carefully noted to date. The results of these experiments are set down hereunder, and from them two main conclusions may be drawn:—

1. That prickly pear seeds possess remarkable viability, inasmuch as intermittent germination has occurred over a period of not less than four years, while, judging by the healthy appearance of the remaining seed, future germination is still possible.

2. That the different preparatory treatments do not increase the germinating properties of the seeds, those subjected to test without treatment germinating the best.

TEST NO. 1. (Commenced 12th June, 1917.)

(*a*) Seeds soaked for sixteen hours at a temperature of 98 degrees Fah. and then for six hours at a temperature of 100 degrees Fah. Then placed between moist blotting-paper and put in germination chamber at a constant temperature of 27 degrees Cent. Total, 200 seeds. One seed germinated 25th October, 1919.

(*b*) Seeds rubbed with a hard stone and then placed between moist blotting-paper, &c., as in (*a*). Total, 100 seeds. None germinated to date.

(*c*) Seeds baked and then placed between moist blotting-paper as in (*a*) and (*b*). Total, 100 seeds. None germinated to date.

TEST NO. 2. (Commenced 28th June, 1917.)

(*a*) Seeds soaked for six hours at a temperature of 100 degrees Fah. and then placed between moist blotting-paper and put in a germination chamber at a constant temperature of 27 degrees Cent. Total, 200 seeds. None germinated to date.

(*b*) Seeds subjected to no treatment whatever, but placed in the ordinary way between moist blotting-paper, &c., as in (*a*). Total, 100 seeds. Ten seeds germinated to date, as follows:—5th July, 1917; 13th July, 1917; 13th October, 1919; 25th October, 1919; 4th November, 1919 (two); 10th November, 1919; 14th November, 1919; 9th January, 1920; 7th April, 1921.

(*c*) Seeds soaked in caustic soda and then placed between moist blotting-paper, &c., as in (*a*) and (*b*). Total, 100 seeds. One seed germinated 25th October, 1919.

TEST No. 3. (Commenced 4th November, 1918.)

In these tests the germination of prickly pear seeds from emu droppings was tested. They were carried out at the suggestion of Dr. Cleland of the Board of Health. No treatment was given to the seeds.

(*a*) Seeds placed between moist blotting-paper and put in a germination chamber at a constant temperature of 27 degrees Cent. Total, 100 seeds. One seed germinated 9th December, 1918; three, 29th September, 1919; two, 3rd February, 1921; one, 7th April, 1921. Percentage of germination to date, 7.

(*b*) Same as (*a*). Total, 50 seeds. Single seeds germinated 3rd January, 1919; 27th September, 1920; 9th October, 1920; 13th November, 1920.

(*c*) Seeds placed in soil in a pot. Total, 50 seeds. Single seeds germinated 29th November, 1918; 14th December, 1918; 5th January, 1919.

The foregoing tests were carried out by Miss M. Bates, and are being continued.

NEWLY RECORDED WEEDS.

AT a meeting of the Linnean Society of New South Wales, on 25th May, Mr. W. F. Blakely exhibited, from the National Herbarium, two weeds not hitherto recorded for the State.

Amarantus deflexus L., "Low Amaranth," common on the railway line between Cowan and Hawkesbury River. (W. F. Blakely and D. W. Shiress, February, 1921.) This plant is widespread throughout Europe, and appears as a weed in other parts of the world. It has the general appearance of *A. macrocarpus* Benth., a native species, from which it differs in the mostly terminal, slender paniculate inflorescence, and in the relatively smooth pericarp. Professor Ewart (Proc. Roy. Soc. Vic., xxxii., 1920, 190) records it for Victoria.

Xanthium commune Britt., the "common cockleburr" of America, which was recently forwarded for identification by Mr. C. A. Horning, of Ebenezer. On investigation two other specimens were found under *X. strumarium*, the Noogoora burr, namely from Cattai, near Windsor (V. C. Giles, 1915), and near Dunedoo (M. Beahan, 1918), thus indicating that this obnoxious plant is spreading unnoticed. The new burr is similar in habit to the Noogoora, but is readily distinguished from it by the more ovate, densely uncinate pubescent burrs. As far as can be ascertained, it is new for the Commonwealth.

Mr. Blakely also exhibited fresh specimens of *Euphorbia Drummondii* Boiss., from Barellan (T. A. Field), with the leaves, flowers and fruits infested with bright pink galls, which give the plant a striking floral appearance. It is not known what physiological change the galls would impart to the plant, or whether they would be injurious to grazing animals.
—J. H. MAIDEN.

Good results are not generally obtained from self-sown Sudan grass, and as the majority of the roots are killed by frost, it is advisable to re-sow each spring.—J. N. WHITTET, Assistant Agrostologist.

Black Spot or Anthracnose.

H. L. MANUEL, Viticultural Expert.

WEATHER conditions experienced last year proved ideal for the development of fungi. The winter months were very wet, and in many parts wet spring and summer conditions existed, added to which "mugginess" was general. Such conditions as these were almost disastrous to the vineyards in the Murrumbidgee Irrigation Area, where a number of growers had not taken precautions to prevent the invasion of downy mildew and black spot.

In the metropolitan areas growers were not in such a bad plight, but a considerable quantity of fruit was badly spotted.

To those who neglected swabbing last year, it will be as well to call to mind this omission, in the hope that it will lead them to attend to the operation this season. Up to the time of writing, the winter has been very moist, and if by any chance the spring and summer months are similar to those of last year, we can look for another bad outbreak of the disease.

We cannot foresee what the weather conditions will be in the future, but I would advise growers not to gamble on the weather, and therefore to swab if only as an insurance. With neglect, one not only stands to lose his crop, but also many vines, for another bad season following upon the last may easily cause numerous deaths.

The fungus attacks the green portions of the vine, and the shoots, leaves, and fruit assume a slightly different appearance. On the berry small, dark brownish spots appear on the surface, and in a short time the centre of the spot sinks. The spot grows larger, and the sunken centre becomes ashen-grey. The margin of the spots become purplish, and the three colours appear in concentric rings.

On the shoots and leaves similar symptoms appear, except the purple margin. The shape on the shoots is eliptical, whereas on the fruit it is more roundish. The diseased parts become shrunken, and appear black and as if burnt. On the leaves the spots are black, and at a later stage the centre falls out, giving it the appearance somewhat of shot-hole.

When the fruit stalk is attacked, the probability is that the whole bunch will dry up. The berries are not only spoilt in appearance by the sunken black markings, but they become deformed in shape, and in many instances they split.

The disease develops more rapidly in humid climates, and particularly on land which is low-lying. Free moisture on green portions is necessary for its development, as well as a humid atmosphere. It requires less heat than downy mildew, and consequently will develop at a very much lower temperature. The disease is an internal one, the mycelium working between the cells of the plant and living upon the surrounding sap.

As it develops it puts off organs of reproduction known as summer spores, which reproduce the disease during the growing period of the vine, and form at the bottom of the shankers, being joined together by means of a gummy substance, which requires a certain amount of free moisture to dissolve it before the spores are set free. The germination of the spores takes place by sending a long filament into the plant tissues. Under favourable conditions during the following spring the gummy substance covering the spores softens, and the spores are scattered to germinate in the usual way.

Controls.—To control the disease attention is necessary to several points.

The first is to burn off all affected cuttings.

Summer treatment with Bordeaux spray is not so effectual for black spot as it is with other fungoid diseases, and we must resort to winter swabbing as our main safeguard.

It is questionable whether early swabbings are beneficial. However, in the Irrigation Areas that had such a bad doing last year, it would be advisable to give two treatments, the first one about three weeks before the second, and the second a couple of weeks before the bursting of the buds. The second swabbing should be done at a period when the coating of the winter spores is likely to be softening, and therefore would prove more beneficial. Besides swabbing the stem and main arms of the vines, it is advisable also to apply the mixture to the trellis-posts or stakes, as these harbour winter spores.

Two swabs are used as follows:—(1) 50lb. sulphate of iron, ½ gallon commercial sulphuric acid, 10 gallons of water. (2) 1 gallon commercial sulphuric acid, 10 gallons water.

The sulphate of iron mixture appears preferable. The mixing of both solutions must be done either in a wooden or an earthenware vessel. Pour the sulphuric acid on the sulphate of iron and stir well, then add the water (which should be boiling), slowly stirring the whole time. The mixture is applied to the vine by means of a brush. A small tarbrush with a long handle will be found convenient for the purpose. The spray manufacturing firms have specially-constructed lead-lined pumps for use on large areas, but the brush certainly makes the better job, and in dealing with small areas it is well to adhere to this method. The best time to make the application is on cloudy days.

Our main commercial varieties chiefly affected with anthracnose are:—Sultanas, Doradillos, Muscats, Currants, Grenache, and Malagas.

A few words may be added for the special benefit of irrigationists. With vineyards which suffered badly last season, it will be as well to irrigate sparingly the coming season, for the more sappy the growth, the less resistance there is to the disease. The vines that were badly hit last year cannot be expected to produce a big crop this season, and consequently one should as much as possible save the wood for the following year.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of wheat, oats, maize, sorghum, Sudan grass, potatoes, and other crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

The list is compiled after inspection of the seed and report by a field officer of the Department (preferably during the growth of the crop), and farmers who have pure high-class seed of good quality of any variety of farm crop are invited to communicate with the Under Secretary and Director, Department of Agriculture, Sydney.

The Department does not undertake to buy any of the seed.

**Sudan Grass* :—	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Temora.
	J. Cavanagh, Curlewis.
Clovers :—	
Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
Maize :—	
U.S. 133...	P. Gersbach, Farm 330, Leeton.
Golden Glow	J. F. Chick, Hillview, Tenterfield.
Wellingrove (late Early Yellow Dent).	Manager, Experiment Farm, Glen Innes.
Iowa Silvermine (late Silvermine).	Manager, Experiment Farm, Yanco.
Funk's Yellow Dent	J. Ditzell, Lansdowne, Inverell.
	Manager, North Bangaroo Stud Farm, Canowindra.
Boone County White	J. Chittick, Kangaroo Valley.
Leaming...	Manager, Experiment Farm, Grafton.
Golden Beauty	R. Richardson, Mondrook, Tinonee, Manning River.
Manning Pride	S. Smith, Karaak Flat, via Wingham.
Golden Nugget...	J. W. Smith, Wauchope.
Manning White	A. McM. Singleton, Henley, Sydney.
Large Red Hogan (late Red Hogan).	Principal, H. A. College, Richmond.
Craig Mitchell	W. D. K. Humphries, Muswellbrook.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy (late Improved Yellow Dent)	D. J. Dorward, Tayfield, Cundletown.
	J. C. Duff, Mount George.
Narrow Red Hogan	C. and L. Bowden, Midlorn, West Maitland.
	P. Mooney, Dumaresque Is., Taree.
Golden Drop	C. and L. Bowden, Midlorn, West Maitland.
King of the Earlies	C. and L. Bowden, Midlorn, West Maitland.
Goldmine	A. Louttit, Moruya.
Yellow Moruya	A. Louttit, Moruya.
Golden King	E. Blackburn, Warkton, Coonabarabran.
Cocke's Prolific...	Manager, Experiment Farm, Lismore.
Manning Silvermine	R. Dyball, junior, Taree Estate, Taree.
Golden Superb	J. H. Teague, Bellimbopinne, via Taree.
Hickory King	C. Lane, Glenthorne, Taree.
Grain Sorghums :—	
Milo	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Bathurst.
Feterita	Manager, Experiment Farm, Cowra.
Manchu Kaoliang	Manager, Experiment Farm, Bathurst.

* Sudan grass should not be sown until all danger of frost is passed.

PURE SEED—*continued.*

Sweet Sorghums:—	
Saccaline...	Principal H. A. College, Richmond.
	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Cowra.
Millet:—	
Japanese	Manager, Experiment Farm, Coonamble.
Potatoes:—	
Satisfaction	O. E. Silk, Nimmitabel.
	J. D. Morse, Black Mountain.
Surprise	O. E. Silk, Nimmitabel.
Lucerne:—	
Grown from Hunter River Seed	W. E. Myring and Sons, Mongaroi, Pallamallawa.
Coolah	R. J. Crossthwaite, Pilca Butta, Leadville.
Peanuts:—	
White Spanish	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm, Yanco.
	Manager, Experiment Farm, Lismore.
Virginia Bush	Principal, H. A. College, Richmond.
Valencia	Manager, Experiment Farm, Grafton.

In addition to those tabulated a number of crops were inspected and passed, but as the growers failed to forward samples their seed has not been listed.

NOTE.—The Department of Agriculture has a small quantity of miscellaneous seeds, such as velvet beans, cowpeas, soy beans, pop corn and sweet corn, for distribution to farmers, and can also supply samples of several varieties of field maize for trial (including some new varieties from America and Africa). Application should be made to the Under Secretary and Director, Department of Agriculture, Sydney.

BLACK APHIS INFESTING BROAD BEANS.

A VEGETABLE grower, whose broad beans were infested with "little black insects about the size of a pin's head," asked the Department what he should do to get rid of them. The reply was that the broad beans were evidently being attacked by black aphis, which collect in thousands on the tender growing points of the plant and live by sucking the sap. Stomach poisons like arsenate of lead are useless in such cases, and it is necessary to spray with a wash that causes death by irritation or suffocation. Kerosene emulsion, or a soap-wash or nicotine extracts may be used, the nicotine extract being perhaps the safest, though the soap-wash (made by dissolving ¼ lb. soap in two gallons of water and applied warm) has given fairly satisfactory results.—A. H. E. MCDONALD, Chief Inspector of Agriculture.

FAULTY HIVES AND THEIR EFFECTS.

FAULTY covers on bee hives, which allow water to get on to the combs, would, if brood-raising were being carried on, be likely to cause chilled brood, and also to affect the temperament of the bees. It is not likely that brood disease would develop from such conditions, but the colonies would certainly be retarded in their work, and from the effect of inefficient covering at this period of the season spring-dwindling might result.—W. A. GOODACRE, Senior Apiary Inspector.

Horticulture.

E. N. WARD, Superintendent, Botanic Gardens, Sydney.

MORE graves are dug for trees than for any other form of plant life. A forester expects big losses when he is compelled to plant by hand as a means of reafforestation, for he is compelled by force of commercial circumstances to plant roughly without much preparation of the soil; but there is no excuse for people who are planting for their own individual pleasure, or even as part of a town improvement scheme, setting trees in pot holes and then leaving them to the attacks of insects and predaceous animals. A young tree requires just as much care as any garden or orchard plant. It is difficult to imagine a man planting an orchard in a rabbit-infested district without protecting his trees, and without pruning, spraying, and, in a dry season, even watering them, yet this is what happens to many trees planted for shade. Planted "for the grateful shade these trees will give to the children of those who fought to keep the good flag flying" was said in a certain town over the planting of a tree for every fallen soldier a couple of years ago, but out of nearly one hundred trees planted about half a dozen remain to tell the tale of what happened to the others—unwatered, unweeded, unstaked, unpruned, inadequately protected. A few suggestions may be offered to those who contemplate tree planting, and especially to any who aim at the beautification of a street or park.

How to Plant Trees.

For a specimen isolated tree, measure off a piece of ground 4 feet square. Dig out the top foot of soil, then with a crowbar, pick, or mattock, if the soil be heavy, break up the bottom to a depth of 4 to 6 inches and leave it where it is, and finally throw back the top foot of soil. In the centre drive a stout hardwood stake, 2 inch x 2 inch, tarred at the bottom, then fix firmly four solid posts 3 feet apart and fasten to three sides a stout mesh wire-netting. Plant the tree carefully, as one would a rose plant in the garden, not forgetting to water it immediately after planting. Tie a piece of soft but durable marline to the stake, make a loop letting the plant swing loosely in the loop, and fix this loop so that in the prevailing wind it will be extended with the wind, not blown up against the stake. Fix up the fourth side of the enclosure with wire-netting, and make a mental note that without rain and with plenty of wind the soil will dry very quickly. The plant should be regularly watered, and the soil cultivated until it is established. The first effort the tree is called upon to make is to struggle through its first summer before its roots have got a firm hold. It is a great mistake at planting time to add manure to the soil, neither should the natural soil be very much altered. Manure helps a tree to make a quick growth that cannot be maintained after the manure is spent, and the plant suffers a check. Rich soil added to the natural also has its bad effects, because when the roots are ready to expand they dislike leaving a rich soil to enter something inferior,

and a check is again the consequence. It is also a mistake to mulch the surface with rich manure, as this only encourages the roots to remain near the surface, whereas they should be encouraged to go down.

How to Care for Them.

In one year from planting the tree should be examined, if possible by an expert. It may require pruning and it may not; if everything is going all right, every bit of foliage should be left, for this is really the lungs of the plant, but if the plant is showing signs of wanting to grow outwards instead of upwards, or to make a head before its time, then it requires assistance and a little guiding by cutting out all strong growths but one, which should be tied to the stake as a leader. This leader must be maintained by checking any other branchlet that shows signs of growing stronger; in other words, guide the main sap flow into the leader, and remember that any cutting away of growth from a maiden tree should be what is necessary only, and that even this is more or less injurious to its health.

As the leader becomes strong and stout, greater care should be given to the method of supporting it to the stake. Ordinary marline is apt to cut and chafe, and the safest method is to make a loop with a piece of old hose pipe, threading through the pipe a piece of pliable wire. Nothing is more important than regularly to examine these trees. A perfect leader may be, and often is, choked by a tight tie, that was perhaps loose enough when it was attached, but that made no allowance for the fact that with kind treatment and congenial weather a young tree swells its stem very quickly.

Watch for pests; if there is to be any disease it will come later. The worst pests on young trees are leaf-eating insects; these should be poisoned, and the best way is to spray with arsenate of lead. The insects keep on feeding on the foliage, and the least bit of the sediment left by the spray will kill most insects. Some young trees are injured by borers, especially our wattles and some imported European trees, but fortunately the presence of these insects is early evident by the borings on the bark from the hole where the insect has entered. Poke into the hole with a piece of stick; this may kill him, but there is a possibility that his brother remains alive, and it is wise to mix into some clay a little bi-sulphide of carbon and seal up the hole with it. If the fumes from this do not kill him he will be too uncomfortable to stay where he is and will do his best to get away. The best preventive against these ravages is kind treatment of the tree and good cultivation.

Planting Avenues.

Where rows of trees are desired—whether in the centre of a street or along both sides, along a country road, or approaching some building—always cultivate a strip of ground in preference to digging the holes as for a single tree.

Plough a strip not less than 5 feet wide as deep as possible, and instead of breaking up the bottom with a crowbar or pick, rip up the bottom of the furrow with a plough from which the mouldboard has been removed. This is no more costly than preparing separate holes by hand labour. The advantage of working a strip is that an even water-table is created and the roots of

trees have a free run of broken-up ground. Even if only the ground immediately round the trees is kept cultivated, the strip of soil never returns to the packed state in which it was naturally, and will always in a measure encourage roots from any kind of vegetation. Trees planted in ploughed strips grow very much better than those in holes, however well prepared.

What to Plant.

Care should be taken in choosing a suitable tree for the particular kind of soil, aspect, and climate. General lists are almost useless. Trees that could be recommended for, say, Lismore and Grafton would, perhaps, be useless at Ballina; and yet trees at all three places could be grown that would be out of the question on the tablelands, as, for instance, at Glen Innes. Many trees may be successfully grown round such elevated places as Wahroonga that would be waste of time in the nearer Sydney suburbs. A selection of trees for various districts and aspects of the State will be given next month.

Trial of Jerusalem Artichokes.

With a view to ascertaining the value of artichokes as a forage crop for pigs, a trial was conducted at Wollongbar Experiment Farm during the past season. On land into which a summer legume crop had been ploughed in July, sets were planted, 2 feet apart, in drills that were 4 feet apart. The season was favourable, though heavy rains in April delayed harvesting until the tubers had commenced to rot. As pigs could not be turned on to the plots, the tubers were dug, bagged, and weighed at the end of April, the yield being at the rate of 12½ tons per acre. Harvesting artichokes for pig food is not a commercial proposition, as it costs £2 10s. to £2 15s. per ton, owing to the small size of the tubers and their distribution.

Mr. G. Nicholson, Experimentalist at Wollongbar, in reporting those results remarks that artichokes cannot be considered a serious rival to the sweet potato in that district, for the following reasons:—

1. Sweet potatoes are better yielders, larger, and cheaper to harvest.
2. Sweet potatoes will keep in the ground throughout the winter, while the artichokes commenced to rot soon after maturity.
3. Surplus sweet potatoes can always be marketed, while artichokes were unsaleable locally last season.
4. It was only after considerable trouble that the pigs were made to eat the artichokes. Preference is always shown for the sweet potato.

These remarks are also applicable to districts similar to that in which the Wollongbar Farm is situated, but where sweet potatoes cannot be grown satisfactorily, owing to climatic and soil conditions, the artichoke is a valuable crop. At Hawkesbury Agricultural College, artichokes have been found very suitable on clay soils. A prolific yield is obtained and the tubers are not harvested, as it is found that the most satisfactory way of handling the crop is to turn the pigs in to forage for themselves. Usually one planting will provide a crop over a number of years, as sufficient tubers are left in the ground each year by the pigs to produce a good stand the following season.—A. H. E. McDonald, Chief Inspector of Agriculture.

Co-operation Among American Fruitgrowers.

The whole of the marketing of both fresh and dried fruit in California is done co-operatively, and practically every variety of fruit produced in any quantity has its own separate organisation for selling the crop. I visited the very large plants of the Prune and Apricot Growers' Association of San José, the Peach Packers' Association and the Raisin Growers' Association at Fresno, the Walnut Growers' Association, and the Citrus Growers' Association, Los Angeles, and others. As practically nothing in the way of fruit is now sold outside such organisations, the prices are fixed by these organisations and very little produce is sold in an open market. The only large fruit market I saw was at San Francisco, and this was very poor indeed. A great deal of fruit was stacked on the footpath and mixed with fowl coops, etc. Generally speaking, the system in this open market was not nearly as good as in Sydney.

Packing and grading is very thoroughly done. Grapes are packed first in small punnets, each holding about 6 lb., and then packed four punnets to a box. Practically all grapes are delivered to packing houses, and thus the whole of the pack is standardised. Special facilities are made on the railways for handling fruit; all the cars in use are refrigerated, and the fruit is air-spaced in the cars with a space left right round the car, laths being tacked across each layer of boxes to prevent any movement of the cases. Californian grapes are railed 2,500 miles to the eastern states, the trip occupying six days, and I saw these grapes being sold in New York and Chicago in perfect condition. The shipping grapes grown are mostly White Malaga and Flame Tokay. The former I have not seen on the Murrumbidgee Irrigation Areas, but Flame Tokay is well known at Leeton, being very subject to sun scald. In California they do not have this trouble with it.

Citrus growers' co-operative packing houses are in a particulary strong position and absolutely rule the market. Taken all round, the distribution of fruit is much more highly organised in America than in Australia and fruit forms a very considerable portion of the food of the people. There is no shadow of a doubt that the salvation of the American fruitgrower has been co-operation.—J. Brady, Cannery Superintendent, in a report on his visit to America.

Uniting Colonies of Bees.

A good method for uniting colonies of bees is as follows:—

Late in the afternoon, the queen should be removed from the weakest stock and after the bees have settled down the hive should be carried to the one with which it is to be united. Remove the cover from the hive on the permanent stand and place a sheet of newspaper over the frames; the removed colony is then freed of its bottom board, and placed on the paper over the permanent hive. The bees will unite gradually through holes they will make in the paper, and there should be no fighting or balling of the queen. In a few days time the colony can be made compact.

Weak colonies can generally be united with success by carefully lifting out the frames containing bees from the hive made queenless and placing them direct in a space made to receive the frames in the hive they are to be united with. Do the work about dusk and be careful not to excite the bees more than is necessary.—W. A. Goodacre, Senior Apiary Inspector.

Poultry Notes.

August.

JAMES HADLINGTON, Poultry Expert.

NOTWITHSTANDING the fact that the autumn and winter months have not been favourable to egg-production, there appears to have been a much larger number of early chickens hatched than is usually the case up to this time of the year.

In advocating early hatchings the writer has not encouraged the idea that all the chickens required should be hatched out in the winter months, but that incubation should be spread over the months of June to September, inclusive, and in such a way that a portion of the very early chickens would come in for breeding stock and the balance be regarded as layers. It has also been pointed out that while this is so, August is probably the best month in the whole season for hatching pullets intended for laying stock. Having in view these facts, it is somewhat disconcerting to find that many poultry farmers have gone to extremes in the early hatching, and are found to have had all their brooding accommodation full and even congested before the middle of July. So much so, that in many cases incubation has had to be suspended while the chickens already hatched are growing up to the stage when they can be safely transferred to other accommodation to make room for any further batches. In some cases the chickens have been moved on too quickly out of the brooders, which is worse than suspension of incubation.

The greatest drawbacks consequent upon swamping the brooder accommodation in the way indicated are, first, that the limited rearing plant found on most farms will not admit of such a large number of chickens being put through in this way as if a regular procession of hatching had been arranged to co-ordinate with the rearing accommodation throughout the different stages, being spread over more months in regular order; and, secondly, the suspension of incubation about the middle of July has cut out the period during which the largest percentage of best layers is hatched, which, moreover, would still be early. True, there will be a set-off in the extra value of the very early-hatched table cockerels, but it is more than doubtful if this will anything like counterbalance the two important drawbacks mentioned, because after all the layer is the most valuable asset on a farm.

Congestion in rearing at any stage means poor development, and poor development, no matter what the breed or strain, means indifferent layers. I will go further, and say that good rearing in the right months is the most important factor in the production of good layers, and conversely badly reared chickens are on the whole bad layers, no matter what their breeding may have been.

However, early hatching is much preferable to late, and it is satisfactory to find that a lesson is being learned that, at any rate, will eliminate much of the prodigious wastage in chicken life that has been a feature of the past.

Hot Water Brooders.

The large number of brooding plants now installed on the hot water circulating system, and the mistakes that are being made, both in the installations and in the operation of them, call for some advice on both aspects.

Dealing with the installations first, it has to be stated that many are faulty in construction, due in some instances to the plumber, and in others to the poultry-farmer, who has conceived notions of his own that deviate from the plans issued by the Department. The result is trouble that would not have eventuated had the plans been adhered to in every detail. Then again, such troubles as do arise might be overcome if the parties concerned would seek the advice which is always available to them. Many who have installed these plants have put up with indifferent working of the circulation, not realizing that more efficient work is obtainable if the operator is put on the right track.

There are two principles upon which hot water circulating brooders can be heated. In one, well known to almost every plumber, the heater is sunk below the level of the pipes to be heated in the same way as for ordinary heating purposes, on the general principle that hot water rises and will circulate better with a gradient. In this system the expansion pipe must be at the highest point of the circulation, viz., the far end. It is, however, not desirable to have a grade in brooder work unless the floor of the brooder house is itself on a grade, as in a case where it is built on a slope. In most cases it is advisable to have the floor of a brooder house level, and it follows that the pipes will require to be level, and about 5½ to 6 inches above the brooder floor. Usually, too, it is undesirable to sink the brooder below the level of the floor, on account of the danger of soakage, or of flooding, which might put out the fire in the night or be a nuisance at any time. To have the brooder on the ground level is therefore the safest plan.

The method of working a hot water circulating system on a level line was discovered by the writer, and was adapted to brooder houses some years ago, and one of the difficulties encountered in getting installations put in according to the plan worked out has been the fact that the principle has not been properly understood by many plumbers. Indeed, the writer has on many occasions been told by experts in hot water circulation that the system could not be worked on a level, but the facts are that it does work, and works well if properly installed in every detail according to the plans issued by the Department. Ocular evidence of this can be seen at Hawkesbury Agricultural College, at Grantham Stud Farm, and now on the sections of hundreds of soldier settlers, as well as on commercial farms throughout the State, and it is only where there is faulty construction or deviation from the plans that trouble is encountered.

Points in Construction.

On ground level installations the following points must be strictly adhered to:—

1. The heater should have a coke capacity equal to a Metters' No. 5 or a Danks' No. 10D "Ideal," if it is to burn from nine or ten hours without re-stoking.
2. The bottom of the supply tank should not be higher than the set-off where the damper is operated, that is, at the intersection of the chimney with the heater. The expansion, sometimes known as the exhaust pipe, must rise from the top of the outflow pipe close to the heater and be taken to a height of 12 feet; this pipe must not be less than $1\frac{1}{4}$ inches.
3. *The pipes running through the brooders must be prefectly level from end to end to insure good circulation.* If not level the circulation will be sluggish, consequently the radiation will be insufficient to maintain a proper temperature. The heaters referred to will work 50 feet of brooders efficiently if properly stoked.

How to Stoke the Heater.

Bad or indifferent stoking is one of the most prolific causes of trouble. It is therefore necessary to give some instruction on this operation.

1. The fuel should be ordinary gas coke, free from dirt or coke dust, and should be broken to a fairly uniform size, and no pieces should be larger than an egg.
2. When full heat is required, the grate at the bottom of the fire box must be kept free from ashes, clinkers or spent coke. Unless this is properly attended to the fire will not burn brightly, and the circulation will be so sluggish that very little radiation will be secured.
3. When stoking up for the night, which should be done about 10 p.m., there should be a few inches deep of good, clear fire upon which to fill the coke that is to burn during the night. To obtain this it will be necessary to clean the rubbish from the fire bars previously.
4. The next important operation is the manipulation of the damper on the top of the stove, and the draught-plate at the bottom. Co-ordination of these, one with the other, is vital to good stoking. Usually the damper is left about $1\frac{1}{2}$ inches open, and the draught-plate at the bottom about $\frac{1}{4}$ to $\frac{3}{4}$ of an inch open, according to the position of the boiler and the character of the weather. On a breezy night, for instance, a $\frac{1}{4}$-inch might be sufficient, while on a very still and perhaps frosty night, it may be necessary to have it much wider, and so on. After all, it must be largely a matter of judgment according to circumstances and conditions, but unless proper adjustments are made, failure will result.

Control of the Temperature.

The control of the temperature in the brooder units is the next thing to claim attention. If the box has been properly constructed, and all the factors already mentioned attended to, there should be no difficulty in maintaining the required temperature, or in the regulation of it, but in many cases the method of regulation and ventilation does not appear to be properly understood. If it is desired to reduce the temperature in any or all of the units comprising the system, all that is necessary is to lift the lids to a height sufficient to let the surplus heat escape. This may be only a ¼ of an inch, or it may be 2 inches, or even more—the height to which it is necessary to lift the lids is easily learnt by watching the thermometers, one of which should be in each unit, with the bulb hanging 2 inches from the floor of the brooder.

It is best to maintain sufficient heat to allow of the lids being lifted somewhat whenever possible, because the air in the brooder is naturally better when the lids are open than when they are closed down. Nevertheless, if the boxes have been constructed with the *small holes at the bottom as per plan* the brooders will be well ventilated for small chickens.

Departures from the Plan.

In connection with these ventilation holes, it has been noted that many operators, not understanding their purpose, have reversed the front so as to bring the holes to the top of the brooder boxes. This is wrong, and it defeats the object for which they are intended, viz., to insure that the vitiated air thrown off by the chickens shall be lifted from the bottom of the box. The reason assigned by many for this deviation from the original plan is that they fear a draught will affect the chickens. This fear is absolutely groundless in respect of the ventilation holes mentioned. What the chicken-rearer has to fear more than draught is want of ventilation, and at the right point. These brooder units are not only the result of practical experience in working them over a long period, but they are scientifically constructed, and are not likely to be improved upon by departure from the plan.

Installation without Boxes.

In connection with this class of brooding, some operators have done away with the boxes, and have substituted something on the hover principle, partially, it appears, with a view to reducing the labour in cleaning, &c. In this connection it will be interesting to users of these installations to learn that the hover principle is not new, but was one of the stages passed through nearly twenty years ago in the evolution of the present system of box units which has proved so eminently satisfactory when the plant is properly installed.

A miscellaneous publication on the hot water circulating system of heating brooders, which affords further information and full plans for construction, is available free on application to the Department.

Orchard Notes.

August.

W. J. ALLEN and S. A. HOGG.

As the past two seasons have been particularly wet, it is only to be expected that during this season there will be another visitation of various fungi. It is, therefore, essential for the successful fruitgrower to spray his trees as a preventive against diseases. As a general spray, that is to say, for fungus and some insect pests, lime-sulphur has come into general use, being valuable as a preventive of leaf curl of peach, black spot and scab of apples, and black spot of vines. In some cases where peach trees have been attacked by black and green aphis, a spraying in the early spring before the buds burst will prove beneficial. For this purpose, nicotine washes may be recommended. In the case of delicate plants, soap may be used, such as sunlight soap. For such pests as red spider and San José scale, lime-sulphur has proved most effective; but for brown, red, and mussel scale red oil emulsion gives better results. In some districts Bordeaux mixture has proved to be more effective in coping with black spot of apples than has lime-sulphur, but the disadvantage about using Bordeaux mixture when the fruit has formed is that the fruit is often scalded and disfigured. In districts where this occurs, Bordeaux may be used as a winter spray, followed up by lime-sulphur in the spring and summer.

Treatment of Vines.

After pruning, the vines should be dressed with a solution of sulphate of iron and sulphuric acid, or with a solution of sulphuric acid alone, as a control for black spot. As the seasons have been wet, it is only to be expected that this disease will be prevalent if steps are not taken to keep it in check. As a preventive of oidium, sulphur should be used. It has been found that the best check to this disease is the fumes of the sulphur—not the direct contact of the sulphur dust. It is advisable to place a small quantity of sulphur dust within the crown of each vine, so that during the warm days the sulphur volatilises and destroys fungus spores that may be floating in the air before they come into contact with the host, which is the young, succulent growth of the vines.

Cultivation.

In cases where ploughing has been delayed, it should be immediately completed, and the orchard from now on kept free from weeds by the medium of the cultivator. In the case of young trees which have been planted this year as re-fills, particular care should be taken to keep the soil thoroughly loosened round them so as to conserve all available moisture. It is often found that re-fills will remain stunted. This being so, an application of well-rotted farmyard manure is recommended. In the first instance, this should be forked into the soil around the young trees, and on top of this a mulch of manure may also be placed. The depth of the mulch should be at

least 3 inches, though deeper would, of course, be more beneficial and lasting. This only refers to re-fills, not to young trees planted in virgin soils. With regard to the ploughing of orchards and vineyards, it is recommended that this work (particularly in the drier districts) should be completed as early as possible after pruning, so as to retain the winter rains.

Green Manuring.

Where one has the control of a water supply, green manuring may be recommended; but where one is depending on the rainfall, it is rather risky, and, generally speaking, under these conditions it cannot be recommended. On the other hand, if a crop of peas or any of the legumes can be grown and ploughed in without robbing the orchard of its requisite amount of moisture, they will prove very beneficial, particularly in heavy soils that require humus and loosening, and in sandy soils that require binding as well as humus. Of course, such crops should have been ready to be ploughed in not later than the beginning of this month.

Artificial Fertilisers and Farmyard Manure.

With the exception of the citrus family, artificial fertilisers have not proved particularly beneficial. On the other hand, such fruits as peaches, plums, apricots, apples, and pears respond readily to the application of decomposed vegetable matter or farmyard manure. Where sheep manure is obtainable it may be used with great advantage as a stimulant to oranges and lemons. As in most cases it is almost impossible to obtain a sufficient quantity of farmyard manure, its use may be confined to the weakened and stunted trees, which may be restored to vigour in that way.

Planting of Young Trees.

It is getting late now for planting, but in the late districts if this work has been prevented by wet weather or other causes, it should be taken in hand without delay. Young trees, as they are removed from the nursery, require pruning before planting. The roots should be shortened to, say, 3 inches from the main upright, and all broken roots removed. In planting, special care should be taken to see that the trees are not planted too deep, and in filling the hole care should be taken not to bruise the roots. The ground should be firmly trampled so as to drive out the air, and the tree should have a firm anchorage. The tops should next be removed to a height of about 15 inches to the ground. In order to ensure the formation of a good even crown, it is found better to remove any laterals, so that dormant buds may receive an equal amount of the rising sap.

Grafting.

The operation may be performed as the sap is rising, which generally takes place about the end of this month. Where it is desired to work over old trees, the scions should have been retarded in their growth after removal either by burial or cold storage. In some cases the variety which it is intended to graft in may be later in starting than the stock which is to be worked. In such cases the grafting wood may be left on the parent tree and cut and used for the grafts as required.

Agricultural Bureau of New South Wales.

REPORTS AND NOTICES FROM BRANCHES.

NOTE.—While gladly publishing in these columns the views of members of the various Branches of the Agricultural Bureau, the Department does not necessarily endorse the opinions expressed.

Adamstown.

This branch met on 30th June, when Mr. P. Vaisey delivered a lecture on the care and treatment of the horse. It was decided to hold a social for members of both ladies' and gentlemen's branches in the spring months.

Ben Lomond.

A branch has been formed at this centre with the following office bearers :—Chairman, Mr. C. D. Judge; Vice-chairmen, Messrs. D. J. Cregan, P. M. Egan and M. McDonagh; Hon. Secretary and Treasurer, Mr. H. W. Weller.

The branch has begun with a membership of over forty.

At a meeting on 2nd July, Mr. M. Reynolds, Inspector of Agriculture, was present and delivered an address on the objects of the Bureau.

It was decided to conduct competitive potato trials of selected seed from various growers, and to give prizes or certificates to the owner of the varieties most worthy for trueness to type, freedom from disease, and yielding capacity, each competitor to supply 56 lb. seed free, the right to reject the seed being reserved. It was decided to conduct the competition through the Potato Growers' Association, arrangements being made with one or more growers to provide the land and carry out the necessary work of planting, cultivating, and harvesting, each plot not to exceed about 1 acre. The potatoes so grown to be at the option of the association for purchase for three months after maturity, the price to be £3 above the average market price at the time.

It was further agreed to appoint three potato growers to attend a conference on the subject of potato growers' interests in order to arrange for joint action in (*a*) the fixing of standard types of each variety; (*b*) granting seed certificates to any grower for any area of potatoes; (*c*) a special potato show (including subsidiary crops, such as maize, peas, &c.) to be held in 1922; (*d*) joint action in other matters of interest to potato growers.

The meeting also expressed the opinion that steps should be taken to formulate a scheme whereby growers' requirements could be procured for them and their produce disposed of on their behalf.

Bimbaya.

At a meeting on 18th June, arrangements were made for the "Carruthers Boys' and Girls' Maize-growing Competition," to which Sir Joseph Carruthers had contributed £2 2s. for the prize fund, and a number of other persons smaller amounts, as well as several special prizes for the girls' jams, jellies and preserves competition.

A discussion took place on the subject of keeping pigs for profit.

Mr. E. H. Filmer favoured crossing the half-bred Tamworth sow with a pure-bred Berkshire boar for bacon pigs. The Berkshire was a good pig but was inclined to fatten while too young, and many of them had to be sold as porkers. The Middle Yorks were very soft and inclined to scald, and were unsuitable as bacon pigs; by crossing with other breeds they might give good results. The Tamworth was a very hardy pig, and in his opinion the baconers were the most profitable for marketing.

Mr. E. T. Boller considered the district very suitable for pig raising, and production could be greatly increased. He found that the Berkshire-Tamworth cross resulted in a pig which was rather slow in fattening. Sows having a slight Tamworth strain, when crossed with a Middle York boar gave good results. Pigs weighing from 120 to 140 lb. were the best for market. Grain and skim milk, fed in the right proportion, gave better results than either fed alone. Breeding sows should be allowed to forage for themselves; it was a mistake to let them get too fat.

Mr. Geo. Alcock favoured the Tamworth-Berkshire cross. He had found them weigh 135 lb. at six months old. A half-bred Tamworth sow put back to a Tamworth boar produced a good bacon pig. He found that the Berkshire fattened too quickly and often went in the legs. A pure-bred Tamworth, if given proper food, would fatten in nine months, and make a good bacon pig. The opening of a bacon factory in the district would mean a more regular market, and he thought more pigs would be raised.

Mr. A. Jones said that to be successful, pig-raising should be run in conjunction with dairying. He had some experience with Berkshires and found they gave good results. He had them weigh up to 140 lb. at seven months. He was trying a half-bred Tamworth sow crossed with a Berkshire boar. Maize and skim milk was a good ration for pigs.

Mr. Haffner said that he had seen good results from a large black sow crossed with a Berkshire boar. He would like to hear other members' opinions on the large blacks.

Mr. E. T. Boller considered the large black had not been a success. Their flesh was inclined to be coarse. The Tamworths were very prepotent, but certainly very slow in maturing. A breed which matured a little earlier was required.

Borenore.

At a meeting on 18th June, arrangements were advanced for lectures at early dates. It was remarked that a demonstration of packing, conducted by Mr. Inspector Broadfoot had been very beneficial, and would be the means of bringing in the use of standard grades in the district.

A pruning demonstration was conducted by Mr. S. A. Hogg, Assistant Fruit Expert, on 22nd June, when valuable advice was given.

A report on the first small consignment of goods purchased by the branch on behalf of members was tabled. Some appreciable savings were effected, and it is anticipated that pool-buying will be extended, and that presently practically all supplies for farmers and orchardists will be procured through the branch.

Castle Hill.

On 13th June, Mr. J. Hadlington, Poultry Expert, visited this branch and delivered a lecture on the rearing of poultry. Great stress was laid on the necessity for keeping the young chicks sufficiently warm to prevent over-crowding in any part of the brooders. Over-crowding caused sweating, with the result that the chicks caught cold.

Chatswood.

On 13th June, Mr. T. McCarthy, Assistant Entomologist, delivered a lecture at this centre on insect pests, keeping a large audience interested for two hours. The principal pests of fruit, vegetables and flowers were described and illustrated by means of a lantern, their life histories sketched, and the methods of control outlined.

Coonabarabran.

The branch at this centre has been re-formed with the following office bearers :—Chairman, Mr. H. H. Moss; Vice-chairmen, Messrs. H. Croxon and H. E. Crane; Treasurer, Mr. H. Inglis; Hon. Secretary, Mr. W. J. Fleming. A programme of meetings has been arranged for the next few months, including a pruning demonstration at an early date.

Cooper's Shoot–Broken Head.

At a meeting on 18th June, a discussion took place on line breeding as a means of improving dairy stock. Several members confessed themselves strongly in favour of the system, quoting some of the leading studs in the State as evidence of its benefits, while others contended that to employ line breeding for any length of time would lead to trouble, as the animals would lose constitution, vigour, &c.

Coradgery.

At the June meeting of this branch, the delegates at the Orange District Conference submitted a report of the discussion and resolutions carried, and remarked that though the attendance at their first conference was not large, the delegates exhibited a great deal of enthusiasm in the movement and were hopeful that next conference would be attended by delegates from many more branches, and that similar conferences would result in considerabl benefit to the Bureau movement.

Mr. P. W. Lorimer read a paper on the past wheat season, from which the following is taken :—

THE HARVEST OF 1920–21.

Owing to the abnormally good wheat-growing season of 1920, any comparison of the merits of the various early and late wheats was unsatisfactory as a record. There being no autumn rains the whole of the crop germinated at the same time—about the middle of June—and with good winter and spring rains all the early wheat made excellent growth and looked like beating the later ripening varieties; but the early summer rains, which in so many cases bleached the early varieties, made very good crops of the late ripeners. The heavy rain and wind of early December tested the standing ability of the straws severely, but in this district it was the midseason wheats which were most affected, as practically all the early varieties were stripped and in many cases the late wheats, such as Yandilla King and Rymer were not thoroughly ripe, and consequently were better able to stand the weather. This was evidenced from the fact that Yandilla King stripped on Adavale was scarcely bleached at all.

Of the midseason wheats, Federation and Hard Federation stood out as the best resisters of the weather, though even Federation, owing to its abnormal growth of straw, lodged badly in places.

Of the early wheats, Canberra yielded 33 bushels per acre and cut up to 3 tons per acre of hay. Improved Steinwedel yielded 31 bushels per acre. Both these were stripped before the rain, and the bushel weights were 66 and 64 lb. respectively. Viking, a midseason variety tried here for the second season, was a beautiful crop until the rain, but lodged very badly. College Purple also lodged badly and showed signs of shelling.

Of the late varieties, Yandilla King stood the weather slightly better than Rymer and was less bleached.

Canberra proved itself to be the best dual purpose wheat of the season, ripening early enough to allow the hay carting to get finished before stripping commenced, at the same time yielding heavy cuts and making excellent chaff.

The whole of the crop on Adavale, just on to 1,100 acres, actually stripped an average of 25 bushels per acre. The loss from the rain can only be estimated, and from a comparison of the crops with that portion stripped before the rain and the returns actually harvested I would estimate it (including loss of weight per bushel) at up to two bags per acre.

The one outstanding feature of the season was the success of the reaper thresher or header in lodged crops, and it was owing to these that the wonderful yields throughout the whole State, in spite of the awful damage by wind and rain, were achieved. Had the same damage occurred ten years ago, I venture to say that not more than 40 to 50 per cent. of the crop would have been secured for market.

Cordeaux-Goondarin.

A turnip-growing competition was conducted by this branch during the past season, and occasioned considerable interest. Mr. R. N. Makin, Inspector of Agriculture, was detailed by the Department to judge the competition, and his report and awards were as follows .—

TURNIP-GROWING COMPETITION.

There were four sections to be judged, viz., (1) the heaviest yield per acre, (2) the heaviest weight per dozen turnips, (3) the dozen turnips most suitable for market grown from Carter's seeds, and (4) the best dozen grown from Yates' seeds.

There were four competitors, to whom points were awarded, in the first section of the competition as follows :—

	Possible Points.	F. March.	E. Walker.	R. J. Fishlock.	E. Reece.
Trueness to type	10	9	8	7	9
Evenness of growth	5	4	3	3	3
Freedom from disease ...	5	4	5	5	4
Cultivation	15	10	15	15	10
Market value	15	10	10	12	9
Yield 30-ton standard ...	50	42	30	24	19
	100	79	71	66	54

The actual yields per acre were :—F. March, 25 tons 6 cwt.; E. Walker, 18 tons 5 cwt.; R. J. Fishlock, 14 tons 5 cwt.; E. Reece, 11 tons 7 cwt.

In the second section the awards were as follows :—E. Walker, 110 lb. per doz., first; F. March, 60 lb., second; R. J. Fishlock, 50 lb., third.

In the third section they were :—R. J. Fishlock, 88 points, first; F. March, 74 points, second.

In the fourth section :—E. Walker, 86 points, first; F. March, 76 points, second; E. Reece, 71 points, third.

In several cases the crops would have scored better if they had been judged earlier, and if Mr. Fishlock's had been thinned more his results would have been better. The turnips seen on Mr. Walker's farm were very fine, but he had not intended to enter the first section, and some roots had been gathered prior to judging. The roots on Mr. March's plot were much more uniform than on the others, and showed better thinning. There is no doubt that turnips of the very best quality can be produced in the locality, and with more attention to thinning and cultivation much better yields could be obtained. The branch is to be commended on the interest in the subject that has been created.

Cunningar.

A pruning demonstration was given by Mr. S. A. Hogg, Assistant Fruit Expert, on 13th June. Visiting first Mr. Ough's orchard, the results of last year's pruning demonstration there were noted, and then, going to Mr. Stock's orchard, a further examination was made of grapes, oranges, lemons and various young trees which were dealt with according to different methods. The results will be watched with close interest.

Dapto.

At this branch, on 9th June, a discussion took place on the breeding and diseases of dairy cattle.

Mr. J. J. COOK, who led the discussion, remarked that only cattle of strong constitution should be selected. Many leading show cattle were line-bred, as their pedigrees showed; this was done by the selection of the best male calf of a sire in successive years, and mating him with distant relatives, but an inbred bull of weak constitution was dangerous. The bull should be pure-bred, selected from heavy producers. It was a mistake to dispose of an old bull if his heifers were good; it was better to keep him and

mate him with old cows, and then if the younger bull's heifers were failures, there would be animals in the herd on whom the farmer could fall back. Heifers from sound healthy cows should be selected.

The subject was discussed by all present, some criticising Mr. Cook's remarks in a helpful way.

Dural.

The annual meeting was held on 5th July, when the following office bearers were elected.—Chairman, Mr. E. L. Archer; Vice-chairmen, Mr. C. T. Hunter and Major Parker; Treasurer, Mr. B. F. Renant; Auditor, Mr. J. W. Thacker; Hon. Secretary, Mr. C. J. Brossois. The secretary expresses confidence that the branch will shortly become more active.

Freeman's Reach.

A meeting of this branch was held on 21st June, when general business was transacted.

Glenfield.

At a meeting of this branch on 17th May, a paper was read by Mr. W. Magee, on wool-classing.

Wool and Wool-classing.

Wool is a modified hair, but differs from an ordinary hair in not being straight, having small waves, which are called crimps. The scales which form the covering of the fibre do not fit smoothly, but the upper edge of each scale projects, producing what is termed a serration. The waves can be seen with the naked eye—in fine merinos as many as thirty to inch. The serration can only be seen with the aid of a microscope, and as many as 3,000 may occur along a length of one inch of fibre; so that wool fibre is just a mass of small cells. Those in the centre are the largest, and as the cells push up or grow from the centre they are pushed out and flatten, overlapping like the scales of a fish, and forming the serrations mentioned.

The crimps give elasticity and softness, while the serrations are a powerful agency in the production of the felting power of wool, and it is due to these properties that it is of such commercial value, as the formation of the fibre enables it to take the very finest of dyes.

The cells in the cross section of the wool fibres, according to experts, are 1,500 in number, and taking the average length to be one four-hundredth part of an inch, there are no less than 600,000 in every inch of single fibre. In strong wools these cells are not so numerous, showing as low as 900 at the cross section.

Ordinary hair differs from wool in that it has a smooth surface and has elongated cells, which contain marrow and will not stretch, but break, but wool will stretch. Looking at wool fibre under a microscope, it resembles a tree, the serrations all overalpping as the bark on a tree.

Wool-classing is quite different from wool-sorting, as in classing the whole fleece is classed, while in sorting the fleece is sorted according to the qualities in the fleece. Classing is the placing of the fleeces in different grades according to the length, quality, soundness, condition and colour. It is bad practice to overclass a clip—that is, to make unnecessary sorts.

The classer is absolutely responsible for the get-up of all the wool apart from the fleece, and before shearing starts he must get the shed hands to have everything in position to take the wool, as a man that knows his work will not have any stoppage through the congestion of wool, and if 3,000 sheep have to be gone through every day, everything in the wool-room must be kept moving all the time to keep the wool clear.

The lecturer then proceeded to explain the operations at different sheds. Numerous photographs of sheds and samples of wool were exhibited, making the lecture very interesting and instructive.

A meeting was held on 21st June, when a paper was read by Mr. P. McDonald on the improvement of social conditions in the country. A eport will be published next month.

Glenorie.

A pruning demonstration was given by Mr. A. T. Hunter on 30th June, the attendance being very satisfactory, notwithstanding a deluge of rain just before. Mr. Hunter's methods were closely followed, and the stream of questions and answers was kept up until dark. The trees treated will be closely watched in this and next season.

A meeting was held on 2nd July, when the pruning demonstration given by Mr. Hunter was discussed with keen interest.

This branch has been allotted space by the Sydney (Metropolitan) branch for an exhibit of fruits early in August. Growers are confident of a good display, both in variety and quality of fruit. The changes in connection with the Great Northern Road were again discussed, as were the prospects of municipal markets in Parramatta. Arrangements were advanced for a show on 10th September.

Some discussion took place on the question whether artificial manures already worked into the soil would be leached away by the recent deluge of rain. The opinion was held by most that though certainly a good deal of the fertilising elements might be leached away, it was better to work the manures in during winter than later on.

Inverell.

The monthly meeting was held on 17th June, Mr. J. Ditzell presiding. Correspondence from the Department gave the names of certain weeds, of which specimens had been sent a month earlier.

The secretary reports a visit by Mr. H. Chapman, Dairy Instructor, on 25th May, when a lecture and demonstration on the points of a cow was given, the result of which was a good deal of interest in the subject of herd-testing, and the likelihood of the formation of a testing association. In a discussion that followed Mr. Sweaney in particular advocated the formation of such an association, pointing out that while in other dairying countries the average production per cow was 250 lb. to 300 lb., in Australia it was only 150 lb. The difference was absolutely due to herd-testing in the progressive countries.

Kangaroo Valley.

On 9th June, Mr. C. C. Crane, Organising Inspector, attended and gave a lecture on co-operation. Mr. Crane indicated the steps that were being taken by other branches, mentioning that between thirty and forty centres had already formed co-operative circles, by which pool-buying of farm requirements could be worked to advantage, large savings being effected owing to the low cost of upkeep.

At a meeting on 20th June, useful discussions took place on a variety of subjects, especially on (1) the effect of colour on the value of a cow; (2) the testing out of poor producing cows; (3) whether it is profitable to hand-feed cows in winter, having regard to the high prices of feeds (it being considered unprofitable at the immediate time, but beneficial in bringing the cows into full profit in the summer); (4) the prevention of diseases among calves; (5) the ill effects that may follow branding; (6) co-operation with Cordeaux-Goondarin branch in an effort to secure an Inspector of Agriculture for the Illawarra and Southern Tablelands to Goulburn.

Kellyville.

On 4th June, Mr. H. Reid gave a lecture on lime-sulphur, describing his method of mixing it for himself. He had had quite satisfactory results in the control of scale and had found it an inexpensive application.

Lower Portland.

The branch met on 9th June, when the secretary's report on the exhibit at the show was considered. The fact that the branch had again gained first prize for a Bureau exhibit, being the third time in succession, was regarded as highly satisfactory.

The local show was a great success, financially and otherwise. The entry was a record one, and there was competition in almost every class. The prize money totalled £42 as against £23 last year.

The branch is now arranging for the annual effort in aid of the District Hospital funds.

March.

A paper by Mr. N. Griffith was read at a meeting on 18th May. A report will be published next month.

On 21st June, Mr. S. A. Hogg, Assistant Fruit Expert, gave a pruning demonstration at Mr. A. V. Howarth's orchard.

Middle Dural.

A meeting for the election of office-bearers was held on 23rd June, when the following were chosen :—Chairman, Mr. R. Roughley; Vice-chairman, Mr. A. C. Hunt; Auditors, Messrs. J. T. Eagle and G. O'Connor; Hon. Secretary and Treasurer, Mr. A. E. Best (*pro tem.*)

A motion was passed asking that the Government should compel manure manufacturers to guarantee the analysis of their product, and that each sack be accompanied by the weight and analysis. Action was also taken relative to section 509 of the Local Government Act, 1919, with reference to a resident medical practitioner.

Milton.

Parallel with the decision of 14th June to purchase two bulls for the use of farmers in the district (mentioned last month), this branch is considering the formation of a herd-testing association, a notice of motion having been lodged to that end.

A pruning demonstration was given by Mr. G. A. Jones on 26th May in Mr. R. Davis' orchard. Many questions were asked during the work on the trees, and much useful information was given. A demonstration of budding and grafting was also given.

Mount Keira.

Mr. G. Jones gave a pruning demonstration at Mr. C. Yates' orchard in connection with this branch on 25th June, when those present were treated to a very interesting and practical lesson on dealing with different fruit trees with a view to maximum production.

Oberon.

At a meeting on 16th June, Mr. G. W. Kelly read a paper on potato-growing, of which a summary follows :—

Potato Growing.

Last year he had carried out tests for the Department with four varieties, each receiving 2½ cwt. superphosphate per acre. The land was not new ground, but had

been cultivated almost continually for the past twenty-five years, and was not o superior quality. In the Up-to-date plot, fully half of the seed never struck. The seed had been obtained from another district, but there was nothing better than the local seed for good results. Of Carman No. 1 quite one-third of the seed missed.

The results were as follows:—Factor, 7 tons 10 cwt. 1 qr. 19 lb. per acre; Manhattan, 7 tons 12 cwt. 1 qr.; Up-to-date, 4 tons 18 cwt. 0 qr. 2 lb.; Carman No. 1, 4 tons 12 cwt.

In future the growers around Oberon should go in more for the big yielding, table varieties. Many coastal farmers, owing to the high price of seed and losses from blight, were finding that potato growing was not sufficiently profitable, and this should be the opportunity for the Oberon farmers.

Manurial Trial with Early Rose.—Local seed was used and planted on 22nd December. Large seed had been cut, and about one-half missed. Some struck and came up, but withered away. The results were:—P9 (10 parts superphosphate, 3 parts chloride of potash, and 3 parts sulphate of ammonia) at the rate of 4 cwt. per acre, 4 tons 9 cwt. per acre; superphosphate, at 2½ cwt. per acre, 4 tons 8 cwt.; superphosphate at 5 cwt. per acre, 4 tons 3 cwt.; M7 (10 parts superphosphate, and 3 parts chloride of potash) at 3¼ cwt. per acre, 3 tons 17 cwt. 2 qr. 10 lb.; P7 (equal parts superphosphate and bone-dust) at 2½ cwt. per acre, 3 tons 11 cwt. 12 lb.; no manure, 2 tons 14 cwt. 2 qr. 12 lb. The most profitable treatment was with 2½ cwt. per acre superphosphate, which (with potatoes at £6 per ton and superphosphate at £6 15s. per ton) gave a profit compared with no manure of £9 3s. 2d. per acre. He had come to the conclusion, after three years' trials, that superphosphate alone could hold its own for economy with the best of manures.

A trial with nitrate of soda had also been conducted last year, and in combination with superphosphate and basic superphosphate, had shown a profit of £2 5s. 6d. per acre.

He had grown potatoes for six years in succession on the same land, and had averaged 4¼ tons per acre. His highest yield had been 9½ tons per acre on new land. He favoured whole seed, for cut potatoes often missed.

Every grower should select his own seed by choosing two good tops in every drill, keeping the potatoes from these plants separate, and selecting the best for seed. He found Blue Manhattan was the best keeper; he had kept them till February. Scab was found more on potatoes grown where fires had been or where there were ashes. He thought potatoes grown on red soil were the better eating. Rank growth seemed more liable to blight.

A discussion took place on the possibility of the establishment of a dairy factory locally, Mr. Franklin (Chairman) believing it to be possible to get one erected if sufficient cows offered. A committee was appointed to collect information regarding the number of promises of support. and to report at the next meeting. About 160 cows were promised in the room.

A potato competition (Satisfaction variety) was won by Mr. G. A. Batchelor, with Mr. G. N. Falls second. Another competition for Manhattans and any white-skinned variety is also projected.

A special refreshment fund has been started by this branch.

Pambula.

Mr. S. A. Hogg, Assistant Fruit Expert, gave a pruning demonstration on 29th June, when much interest was shown in the different methods of pruning, especially of peaches. Those present indicated that they would closely watch the behaviour of these trees next season. A demonstration of grafting and bud-grafting was also given.

Penrose-Kareela.

The monthly meeting was held on 13th June at Mr. C. P. James' residence, when useful discussion took place on a number of subjects.

Rydal.

At a meeting on 20th June a paper was read by Mr. A. Lemon, of which a report will appear later.

Springside.

The following is a summary of a lecture delivered before this branch by Mr. W. R. Birks, Inspector of Agriculture, on 24th May :—

Green Manuring, and Rotation of Crops.

The presence in the soil of nitrogen is absolutely essential to the growth of plants. The most economic source of nitrogen is leguminous crops, like trefoils, vetches, peas, &c., which should be grown every second or third year. At present it does not pay to use the nitrogen in the various artificial nitrogenous manures.

Humus is also absolutely necessary, and its supply in the soil must be maintained. The presence of humus increases the moisture-carrying capacity of the soil, tends to keep the soil from setting, and provides food for the soil bacteria. It results from the rotting of vegetable matter. On a rough average, the quantity of humus in new ground is about 20 tons per acre, and the rate of loss per annum is approximately 1 ton per acre. The humus resulting from the decomposing roots and stubble of a wheat crop amounts to about half a ton per acre.

The system of replenishing the humus supply by adding farmyard manure is practicable in England, because in many parts they stable their stock all the year round. In Scotland cattle are brought over from Ireland, and never leave the stables for months at a time. Tons of straw are used daily for bedding, and a large quantity of turnips for feed. These all decompose and remain on the floor, often to a depth of about 4 feet, until the whole is carted out on to the paddocks.

Here in Australia, however, farmyard manure is almost a negligible quantity, and is not sufficient to supply the gradually diminishing quantity of humus in the soil, so we must adopt other methods.

It hardly pays to grow a green crop and merely plough it under in order to increase the supply of humus in the soil. It is more profitable to graze off the greenstuff and plough under the droppings from the sheep. The loss of humus-producing material in feeding off greenstuff is only about 5 per cent., as the following example will show :— Every ton of hay is equivalent to about 3 tons of greenstuff. So a good crop of greenstuff can be put down at about 6 tons per acre. If we graze this off by periodically running twenty sheep on it, we shall find that sheep going in at 80 lb. will come off at about 110 lb. That is to say, each one has absorbed 30 lb. material, and the twenty have absorbed 600 lb., or about a quarter of a ton. From the crop of 6 tons of greenstuff, the sheep have removed only about 5 per cent. in total weight, and yet in normal times they will show a substantial profit as fat sheep. Practically the whole of the balance of the crop is discarded by the sheep, and lies on the ground in the form of manure. The proportion of phosphates lost is about 10 to 20 per cent., nitrogen about 5 to 10 per cent., and potash about 2 per cent.

One of the few occasions when we should be justified in ploughing under greenstuff is in orcharding, as the stock might damage the trees. Peas, or similar crops, could be grown in the early autumn, and ploughed under in, say, June or July.

On an average, a sheep produces one-third to one-half ton of manure per annum, while a horse produces 2 to 3 tons. So that one horse or three or four sheep per acre will produce enough manure to maintain the humus supply where land can be grazed every second or third year.

In brief, the main objects of rotation are to get rid of weeds and diseases, and to replenish and balance the plant-food in the soil. Certain weeds are peculiar to certain crops, and eventually render the crops useless. For instance, black oats mature earlier than wheat and therefore increase tremendously every year if not controlled by a system of rotation or fallow. The standard of the agriculture of a country may be judged by the length and complexity of the rotation practised. Thus, Denmark is one of the most progressive farming countries in the world. Practically all the farms there—even the small ones of 10 acres—are divided into eight or nine fields, and some such rotation as the following is adopted:—(1) Rye; (2) sugar-beet; (3) oats; (4) mangolds; (5) barley; (6) oats; (7) and (8) clover and grasses; (9) turnips, horse-beans, &c.

The Scottish are among the best of English-speaking farmers, and they adopt the following rotation :—(1) Turnips, to clean the ground and provide feed for cattle; (2) oats, which is a revenue-producing crop, but which dirties the ground; (3) potatoes, which is also a revenue-producing crop, but which cleans the ground; (4) barley, which is a revenue producer, and which mothers the clover and grasses; (5) and (6) clovers and grasses, which supply fodder and renovate the land.

A standard English rotation is: (1) wheat; (2) potatoes; (3) oats; (4) fodder crop.

In the Wimmera wheat district in Victoria, the system is: (1) bare fallow; (2) wheat; (3) grazing.

On Mr. W. Burns's farm in the Carcoar district, the Agricultural Department is experimenting with a two-year rotation consisting of (1) cereals, (2) fodder crop, and (3) potatoes. The cereal occupies the ground from May to December; the fodder crop from February to August; and the potatoes from October to April. The average value of the yields per acre per annum have been:—1914–15, £8; 1916–17, £8 15s.; 1918–19, £9; 1920–21, £10 15s., with the cereal crop yet to come. The land on which these experiment plots are situated is considered only second-rate for the district, but after seven years of the rotation increasing gross returns have been obtained and the ground, if anything, has been improved in condition and is remarkably free from weeds and disease. Although it might not be possible to work all the land in the district on those lines, still some system of change of crop should be adopted for every paddock. In arranging such a system, the following principles should be used as a guide:—

1.—Summer crops that have been intercultivated (*e.g.*, potatoes, maize, &c.) should be followed by a cereal immediately after the former has been harvested.

2.—These summer crops require deep ploughing, whereas the cereals can do with shallow cultivation, provided the land has been deeply ploughed within twelve months.

3.—Oats should be put on land where the previous cereal crop was wheat, and *vice versa*.

4.—Every paddock should carry a leguminous crop, at least (on the average) every three years.

5.—No ground should carry the same crop, or class of crop, two years in succession.

6.—All stubbles should be grazed off, preferably with sheep or pigs, and every second or third year a special forage crop should be raised, which should be entirely grazed in the paddock.

It will be seen that the system involves keeping a larger number of live stock than is general in the district, which is a desirable and inevitable reform if agriculture is to prosper. In no other way can land be continually cropped, and yet be maintained in such a condition of fertility and tilth as to be capable of yielding increasingly heavy returns.

Stratford.

The subject of the dairying industry and of the value of herd testing was discussed on 18th June, when a recent article on the subject by Sir Joseph Carruthers proved a useful starting point.

Sydney (Metropolitan).

A meeting was held on 23rd June, when papers were read by Mr. E. Breakwell on the examination and testing of imported seeds, and by Mr. E. Cheel on the cultivation of pulse.

Testing Imported Seeds.

In the course of his paper Mr. Breakwell stated the method of procedure under the Commonwealth quarantine regulations. A sample of the imported seed was taken from the bulk consignment on the wharf and examined at the seed-testing laboratory at the Botanic Gardens. All the weed seeds were picked out from a definite weight of imported seed. These seeds were identified by means of a standard collection of weed seeds common to different parts of the world. If it was found that such weed seed were likely to be a serious menace to the State, or even that the percentage of seeds of weeds already established here exceeded a certain standard, the parcel of seed was condemned until such impurities could be removed. As an example of the manner in which noxious weed seeds could enter this State, if restrictive action were not exercised, the following weed seeds were picked out and identified in a sample of seed labelled "mixed grass seed," which entered this State just recently:—Sorrel, 32,960; dock, 3,136; wire weed, 288; fat hen, 96; self-heal, 160; scirpus, 240; spurry, 16; Canadian thistle, 16; slender thistle, 16; field cress, 16; hawkweed, 16; ergot, 3,200.

Such legislation protected the farmer, but a serious drawback was the fact that only imported seed was examined. All State or interstate seed was not examined, and it was obvious that State pure seed legislation was necessary to enforce this.

PULSE CULTURE.

In the course of his remarks, Mr. Cheel stated that in California there were fifteen varieties of beans cultivated as staple crops. In 1917, 558,000 acres of land were under bean crops, which yielded eight million bushels of dry beans, constituting 44 per cent. of the entire crop of the United States.

French or Kidney Beans were great favourites with all Europeans as a green vegetable, and in some parts of France large crops of the white-seeded forms were grown for the dry seeds, which were called French haricot beans, and were superior in flavour to those sold by Sydney grocers as haricots. Under favourable circumstances the best varieties of French beans would yield up to 200 bushels of pods per acre; these were excellent as green vegetables.

Lima beans, Mung bean (known under several names, including Jerusalem pea), and Adsuki bean (also known as Jerusalem pea) were also referred to.

As a green manure plant there was nothing better than Rice bean, especially for the warmer parts of the State. The vine was not so coarse as that of the Velvet bean, hence it was more easily dug in than the latter. It was an excellent crop for weed suppression, and had proved successful as a cover crop in banana plantations.

Chickling vetch, or so-called Indian peas, was cultivated in some parts of Europe as a ood crop for cattle, and occasionally it could be seen under cultivation in this State, but on account of the harmful effects of the seeds on human beings and even cattle when used as food, it was inadvisable to encourage its cultivation.

On 1st July, Mr. L. T. McInnes, Dairy Expert, gave some information on milk and its products, and several speakers contributed opinions on different aspects of this subject.

Many farmers were receiving very poor returns for their labour and outlay, and were also deprived of many of the advantages possessed by city workers. The outstanding cause of failure was the poor quality of the dairy stock and consequent low milk yield, the remedy for which was herd-testing with a view to the increase of the production of milk and butter-fat, and the importation of pedigree stock. A series of slides was screened picturing prize cattle from local herds, with tables showing their milk records.

Mr. W. A. Champney, of the Soldiers' Settlement Branch, illustrated the old type of slab hut, without comfort or adornment, and compared it with the pretty modern cottages, replete with every convenience, that have been erected on the Kameruka estate. Methods of cheesemaking were also referred to, including cheddar cheese.

Mr. S. Borcholdt gave an account of the condensed and preserved milk industry, screening a series of cinema films to illustrate the story.

Sir Joseph Carruthers, in opening the discussion, remarked on the high food value of milk and its products, and quoted from recent authorities on the subject of those elusive but necessary bodies known as vitamines, in which milk and butter were extremely rich. Subject to the keeping of a better class of stock and improved methods of management, this industry could be made sufficiently remunerative to pay good wages.

Profes.or Watt also took an optimistic view of the industry, pointing to the favourable conditions that obtained in Australia as against Canada and Great Britain, where the animals had to be stall-fed for a good part of the year.

Professor Douglas Stewart emphasised the necessity for farmers acquiring a knowledge of the constitution, anatomy, and physiological functions of the animals under their care, and pointed to numerous losses by stockowners, due to ignorance of the various causes,

Tahmoor.

The following is a summary of the paper read by Mr. A. Crane on the 14th May :—

THE MARKETING OF OUR FRUIT CROP.

If the grower took the distribution of his fruit into his own hands, he would very soon overcome the whole of his difficulties as far as selling was concerned. The means that should be employed were—(1) co-operative selling, (2) decentralisation of supplies, (3) packing the greater part of the fruit into half or quarter bushel cases.

As to the first of these, local or district co-operation would be the best in dealing with fruit. Where a number of growers in any one district were personally acquainted with each other and working under the same local conditions, and where all saw and understood that their welfare lay in a change of marketing methods and were a

determined to make co-operation a success, the feeling of good-fellowship and honourable understanding which was essential to success in co-operation would exist. He opposed the formation of a larger company, because a group of local growers selling their own highly perishable produce would be careful of their own interests, and would have a thorough grip of the details of the business, whereas with a larger company the fruit must necessarily be handled by men whose only obligation would be to dispose of it, perhaps to the advantage of the grower or perhaps not.

Speaking on decentralisation, his idea was for an association of growers to open up a depôt or market in any centre of population on which they might decide, then to thoroughly canvass that district for orders. There was no fear of not being able to sell the fruit, for in spite of a glutted wholesale market, the public had not been able to obtain the fruit they needed. The association could supply them with fresh fruit straight from the orchard at a price much below what they had been used to paying at the shops. This would create an excellent demand, and as trade grew other branches could be opened and the first one used as a central depôt, to which all fruit should be consigned, and the other branches would be fed from it as required. Opportunities for extending trade would constantly be presenting themselves, and the association would only have to see that the opportunities were taken advantage of.

In the retail trade, except in the case of large orders, it would be advisable to discard the use of the bushel case and to offer the fruit to the public in half and quarter bushel cases, as far more fruit could be sold in that way. The smaller cases did not hold too much fruit for a family to use while it was fresh, and while there would be a little more work attached to packing in small cases, the increased trade would amply justify the extra trouble.

Good trade could also be secured in jam fruit, which would furnish an outlet for second and third grade fruit. It was surprising how many people would make their own jam if they could get suitable fruit at a reasonable price. In a district where there was enough fruit grown to justify the outlay, a small factory might be established for canning, drying, and jam-making. This processed fruit could be retailed to the public in the off season, and would be a sure means of revenue, as well as a partial solution of the marketing problem.

On 11th June two papers were read at a meeting, one by Mr. G. Catt on potato-growing, and the other by Mr. G. R. Stewart on poultry.

Mr. Catt advocated that seed should be selected early and stored in a cool place to prevent early shooting. Any young shoots that made their appearance should not be rubbed off, as that tended to weaken the tuber. If the tubers did not shoot early enough, they could be covered with old bags, grass or straw, but he preferred covering them with dry manure (not too heavily) so that the tubers would give strong shoots. In cutting, the pieces should not be made too small, as the shoots had to feed on the piece of tuber until the roots were formed. In very wet ground he would advise not cutting the seed at all, as they were likely to rot, but sets should be picked with as few eyes as possible. He preferred sowing 3 inches deep and with a fair width, so as to allow room for hilling up. Before hilling a light dressing of superphosphate might be sprinkled along between the drills, and then hilling should be done in two operations, the first when the plant is about 5 inches high and the second before flowering.

It was worse to leave the tubers too long in the ground than to dig too early. He advised digging as the vines turned yellow and commenced to drop their leaves, and storing when quite dry in a dry shed on a board or bark floor and without heaping too thick, but allowing as much draught as possible. It was advisable to avoid sowing potatoes twice in the same ground without a rotation of such other crops as peas or beans, cabbages, or something else.

Tennyson-Kurrajong.

Members of this branch met on 6th June, when Mr. W. S. Arnold delivered a lecture, of which a full report will be published next month.

Thyra-Bunaloo.

The pooling system of handling wheat was discussed at a meeting of this branch on 19th June. While the system came in for some criticism, the meeting favoured a compulsory pool controlled by elected representatives of the wheat-growers, providing the financing could be done without Government interference.

Tilba.

A meeting was held on 15th June, when several matters were discussed, including the formation of a herd-testing association, and it was agreed to ask the Department to send an officer to afford advice and assistance in the matter.

Toronto.

This branch on 6th June considered a letter from the Wallsend branch, asking for co-operation with other branches in the district in forming a farmers and fruitgrowers' co-operative society, and the matter was favourably discussed.

Mr. H. Filmer read a paper, of which a report will be published later.

At a meeting on 6th July the question of representation at the conference on the subject of a district co-operative society was further discussed, and delegates were appointed.

The branch also considered the question of poultry foods, and decided to ask the Department for the analysis of a number of common foods and the amounts necessary to feed, say, 100 fowls.

Warrah Creek.

On 18th June this branch advanced a number of matters of local interest in which it has been moving, including certain road work, erection of a telephone line from Warrah Creek to Willow Tree, site for a local hall, site for a co-operative sheep-dip, proclamation of stinkwort as a noxious weed in the shire, and framing of rules for the branch.

Wellington.

The annual meeting was held on 21st June, when the balance-sheet submitted by Mr. Kimbell, treasurer, showed a deficit of £6 17s., the flower shows having resulted in appreciable losses. The subsidy, £2 17s., had yet to be credited.

The report showed that in addition to the flower shows, several useful meetings and demonstrations had taken place that had been of profit to members.

The election of officers resulted thus :—Chairman, Mr. H. H. A. Flannagan; Vice-chairmen, Messrs. A. V. Brown and D. Wilkins; Treasurer, Mr. C. Kimbell; Hon. Secretary, Mr. A. Hobson; Organisers, Messrs. F. Davidson and D. Wilkins.

Wentworthville.

A short lecture was given by Mr. C. Giddey on the 8th June, his subject being the extermination of ants. The method recommended was to make four or five holes with an iron bar, at an angle in the side of the hill, insert a lump of carbide of calcium in each, fill with water and close up the holes with clay or mud. This had proved a permanent success.

Yarrunga-Avoca.

On 18th June Mr. E. Breakwell visited this branch and gave a lecture on weeds and grasses, which will be reported later. Delegates were appointed to attend a conference to be held at Moss Vale on the subject of an exhibit at the local show.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1921.

Society.	Secretary.	Date.
Murrumbidgee P. and A. Association (Wagga)	A. F. D. White	Aug. 23, 24, 25
Forbes P., A., and H. Association	E. A. Austen	,, 23, 24
Parkes P., A., and H. Association	J. Heel	,, 23, 24
Corowa P., A., and H. Society	J. D. Fraser	,, 30, 31
Grenfell P., A., and H. Association	G. Cousins	,, 30, 31
Hills District Fruitgrowers' Association (Galston)	B. F. Renant	Sept. 3
Young P. and A. Association	T. A. Tester	,, 6, 7, 8
Albury P., A., and H. Society	A. G. Young	,, 6, 7, 8
Gunnedah P., A., and H. Association	M. C. Tweedie	,, 6, 7, 8
Tullamore P., A., and H. Society	H. W. Clarke	,, 7
Manildra P. and A. Association	A. Anderson	,, 8
Cowra P., A., and H. Association	E. P. Todhunter	,, 13, 14
Ganmain A. and P. Association	A. R. Lhuede	,, 13, 14
Cootamundra A., P., H., and I. Association	C. H. Inson	,, 14, 15
Northern A. Association (Singleton)	J. T. McMahon	,, 15, 16, 17
Canowindra P., A., and H. Association	John T. Rue	,, 20, 21
Holbrook P., A., and H. Society	J. S. Stewart	,, 20, 21
Temora P., A., H., and I. Association	A. D. Ness	,, 20, 21, 22
Burrowa P., A., and H. Association	W. Burns	,, 22, 23
Henty P. and A. Society	H. Wehrman	,, 27, 28
Junee P., A., and I. Association	T. C. Humphreys	,, 27, 28
Murrumburrah P., A., and I. Association	W. Worner	,, 27, 28
West Wyalong and District P., A., H., and I. Assoc.	T. A. Smith	,, 27, 28, 29
Deniliquin P. and A. Society	P. Fagan	,, 28
Hay P. and A. Association	C. L. Lincombe	Oct. 5, 6
Narrandera P. and A. Association	W. Canton	,, 18, 19
Hillston P. and A. Society	J. E. Peerers	,, 20
Tweed River A. Society	T. M. Kennedy	Nov. 16, 17
Lismore A. and I. Society	H. Pritchard	,, 23, 24

1922.

Society.	Secretary.	Date.
St. Ives A. and H. Association	A. K. Bowden	Jan. 13, 14
Albion Park A. and H. Association	H. R. Hobart	,, 20, 21
Kiama A. Society	G. A. Somerville	,, 25, 26
Wollongong A., H., and I. Association	W. J. Cochrane	Feb. 2, 3, 4
Inverell P. and A. Association	A. L. Varley	,, 7, 8, 9
Shoalhaven A. and H. Association	H. Rauch	,, 8, 9
Central Cumberland A. and H. Assoc. (Castle Hill)	H. A. Best	,, 10, 11
Southern New England P. and A. Association (Uralla)	H. W. Vincent	,, 14, 15, 16
Nepean District A., H., and I. Society (Penrith)	C. H. Fulton	,, 16, 17, 18
Dapto A. and H. Society	J. T. Geeson	,, 17, 18
Guyra P., A., and H. Association	P. N. Stevenson	,, 21, 22
Moruya A. and P. Society	H. P. Jeffery	,, 22, 23
Newcastle A., H., and I. Association	E. J. Dann	,, 22 to 25
Robertson A. and H. Society	E. S. Martin	,, 24, 25
Tenterfield A. Society	E. W. Whereat	Feb. 28 Mch. 1, 2
Oberon A., P., and H. Association	C. S. Chudleigh	March 2, 3
Berrima District A., H., and I. Society	W. Holt	,, 2, 3, 4
Glen Innes P. and A. Society	Geo. A. Priest	,, 7, 8, 9
Campbelltown A. Society	J. T. Deane	,, 10, 11
Cobargo A., P., and H. Society	T. McKennelly	,, 15, 16
Barraba P., A., and H. Association	C. E. Williams	,, 15, 16, 17
Tamworth P. and A. Association	F. G. Callaghan	,, 21, 22, 23
Hunter River A. and H. Association (Maitland)	E. H. Fountain	,, 22 to 25
Camden A., H., and I. Society	C. C. Irving	,, 23, 24, 25

[Subsequent fixtures are noted but held over.]

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Agricultural Gazette of New South Wales.

Farmers' Experiment Plots.

POTATO EXPERIMENTS, 1920-21.

Upper North Coast District.

W. D. KERLE, Inspector of Agriculture.

EXPERIMENTS were conducted with potatoes in the season 1920-21 in co-operation with the following farmers:—

Henry Short, "Warrawee," Dorrigo.
F. Allard, "Glenrose," Brooklana, Eastern Dorrigo.
F. Johnson (Mrs.), Condong, Tweed River.
A. Cortes, Mullumbimby, Brunswick River.
G. Long, "Glengarry," Tatham, Richmond River.
A. Eggins, "Bromley," Grafton, Clarence River.
E. N. Mackinnon, Lawrence, Clarence River.
T. J. Jarrett, "Edgefern," Nana Glen, Orara River.
M. J. Reedy, Warrell Creek, Nambucca River.

The plots at Brooklana were ruined by flood rains in January; germination and growth to the flowering period had been excellent.

The Season.

The season was, for the most part, favourable. Winter rains were abundant and although August was dry, ample rains fell during the growing period. Unfortunately Irish blight (*Phytophthora infestans*) made its appearance in the plots at Dorrigo and Tatham, and considerably reduced the yields. It would appear from this and previous outbreaks that the conditions conducive to the development of the disease are excessive humidity, midsummer temperatures below normal, and an excessive rainfall. Considerable damage to the foliage of the plots at Condong, Grafton, Lawrence, Tatham and Warrell Creek was done by the ladybird beetle (*Epilachna 28-punctata*), which is often mistaken for the pumpkin beetle, though quite different in colour, shape, size and markings. This ladybird belongs to the only group of the genus *Epilachna* which is leaf-eating in both grub and adult stages, all others being particularly valuable in destroying aphis, scale, &c.

The rainfall for the chief months of growth was as follows:—

Month.	Dorrigo.	Nana Glen.	Grafton.	Lawrence.	Mullumbimby.	Condong.	Tatham.	Warrell Creek.
1921.	Points.	Points.	Points.	Points.	Points.	Points.	Points.	Points.
August ...	...	..	...	...	...	36 (fm 18th)	...	...
September ...	...	246	320	314	381	448	311	...
October ...	648	676	581	592	450	434	524	308
November ...	1,051	413	311	291	420	424	819	476
December ...	234	124 (to 16th)	...	...	...	...	330	350
January ...	900 (to 13th)	...	...	...	...	...	.	246
Total ..	2,833	1,459	1,212	1,197	1,251	1,342	1,984	2,380

Details of the Plots.

Dorrigo.—Soil red, volcanic, free-working, typical of best soil of plateau: site of experiment, new ground; only previous crop a light one of late maize. Ploughed the end September and harrowed. Plots drilled in 7th to 9th October, in rows 2 ft. 6 in. apart, sets 12 inches to 15 inches apart in rows; pressed firmly into loose soil with the foot and covered with plough. Soil moist and in good condition at planting. All plots germinated excellently, and the weather conditions being particularly favourable, the growth of haulms was rapid and luxuriant. The crop was hilled on 22nd November, and when seen on 3rd December presented a particularly clean and healthy appearance, the early varieties being in flower and the tops meeting between the rows. The tubers set well and gave every promise of exceptional yields, until, following on a week of particularly wet and cool weather, early in January, 9 inches of rain fell. Irish blight made its appearance, and the tops were reduced to a black mass of diseased foliage in less than a week. Harvesting was not done until June, by which time the diseased tubers were rotted away and the crop was clean and apparently disease-free. It is estimated that fully two-thirds of the crop was lost by disease. This is the second outbreak of blight in this locality in the last ten years. The varieties most affected by the disease were Manhattan, Plunkett, Coronation, Carman No. 1, and Surprise. The comparative resistance of the varieties is reflected in the yields. In the case of Satisfaction and Early Manistee, which head the list, their yield is more likely due in this instance to their earlier maturity than to actual powers of resistance. In the previous two years' trials under normal conditions, Satisfaction has yielded badly, occupying fourteenth and thirteenth places respectively, and Early Manistee little better, being thirteenth and seventh. Langworthy, on the other hand, has shown a remarkable consistency, being second, first, and third in the last three seasons, with an average yield of 10 tons 5 cwt. 2 qrs. per acre. For the same period the most consistent varieties have been Factor, 9 tons 16 cwt. 1 qr., Up to Date, 9 tons 10 cwt. 2 qrs., Carman No. 1, 9 tons 6 cwt. 1 qr., and Coronation, 9 tons 4 cwt. 2 qrs. Small plots were planted at this centre to increase the quantity of seed for trial next season of the following new varieties:—Tasma (*Commersoni Italiani*), Arran Chief, Dalhousie, Scottish Triumph, Trafalgar, Carman No. 1, and Cooke's Favourite.

The manurial trial, sown with Langworthy, showed a remarkably increased yield with a comparatively heavy application of superphosphate. In previous trials 3 cwt. was the heaviest dressing, but an additional 2 cwt. this season gave an increase of 1 ton 6 cwt. 3 qrs. 14 lb., equal to 2 tons 2 cwt. 1 qr. over unmanured. The latter increase is remarkable as the trial was conducted on new ground. Despite the prevalence of blight in this crop, Mr. Short secured first prize for varieties at the Royal Agricultural Show, Sydney, and at the local shows at Dorrigo, Bellingen, Grafton, Ulmarra and Maclean. The potatoes exhibited in the North Coast district and Department of Agriculture's exhibits at the Royal Show were mainly secured from these plots.

RESULTS of Potato Variety Trials.

—	Dorrigo.	Nana Glen.	Grafton.	Lawrence.	Mullumbimby.	Condong.	Tatham.	Warrell Creek.
Date sown.	8th and 9th Oct.	1st Sept.	7th Aug.	10th Aug.	23rd Aug.	18th Aug.	25th Aug.	22nd Sept.
Fertilised with ...	Superphosphate, 3 cwt.	P7, 3 cwt.	Superphosphate, 3 cwt.	P6, 3 cwt.	P6, 3 cwt.	Superphosphate, 3 cwt.	Superphosphate, 3 cwt.	Superphosphate, 3 cwt.
Effective rainfall	28·33 in.	14·59 in.	12·12 in.	11·97 in.	12·51 in.	13·42 in.	19·84 in.	23·80 in.
	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.
Satisfaction ...	6 1 0 0	7 13 0 24	2 18 2 6	3 17 0 0	3 10 1 0	3 18 0 0	2 0 0 0	4 19 2 6
Early Manistee ...	5 12 1 10	7 1 1 20	3 19 2 0	3 13 0 0	Failed.	4 12 3 0	2 4 3 0	3 11 3 0
Langworthy ...	5 11 3 14	....	....	....	....	....	....	....
Adirondack ...	5 11 0 0	....	....	....	....	....	....	....
Up-to-date ...	5 10 1 24	7 15 1 12	3 13 3 0	5 14 1 0	7 10 0 0	3 5 3 0	3 11 2 0	5 18 0 20
Factor	5 10 0 0	8 7 0 16	5 6 3 18	3 6 3 0	8 19 0 0	4 10 1 0	3 1 0 0	5 7 0 16
Carman No. 1 ...	5 4 2 8	8 1 3 4	2 13 1 0	3 10 1 0	4 16 1 0	3 15 2 0	4 7 0 0	4 9 1 4
Brownell's Beauty	5 2 1 0	....	5 5 1 0	5 18 0 0	8 12 0 0	4 16 2 0	2 2 3 0	5 6 1 0
Manhattan ...	4 16 0 0	8 11 1 20	7 5 3 0	4 8 0 0	6 2 3 0	5 8 3 0	3 10 0 0	5 18 1 6
Coronation ...	4 15 1 20	....	....	....	....	....	....	....
Surprise	4 15 0 0	6 13 3 20	....	....	....	....	....	....
Queen of Valley ...	4 11 2 18	....	....	....	....	....	....	....
Early Rose ...	4 7 1 10	....	....	....	6 19 0 0	....	....	....
Blue Manhattan ...	3 12 2 12	....	....	....	....	....	....	....
Improved Brownell's Beauty ...	3 5 1 18	7 0 0 0	....	....	....	....	....	....
Plunkett ...	3 0 3 24	....	....	....	....	....	....	....

RESULTS of Potato Manurial Trials.

—	Nana Glen.	Lawrence.	Dorrigo.	Warrell Creek.	Tatham.	Condong.	Grafton.
Date sown.	31st Aug.	11th Aug.	7th Oct.	21st Sept.	24th Aug.	17th Aug.	8th Aug.
Variety employed	Up-to-date.	Up-to- ate.	Langworthy.	Manhattan.	Manhattan.	Brownell's Beauty.	Manhattan.
	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.
Superphosphate 5 cwt. per acre.	8 9 1 4	8 17 0 0	6 18 1 0	6 9 1 24	3 11 1 0	3 18 0 0	6 18 2 11
P5 ... ... 2½ " "	8 3 3 20	8 8 3 12	5 1 1 0	4 18 0 24	3 0 0 0	3 16 0 0	6 17 3 4
P8 ... ... 3 " "	8 3 1 16	7 5 2 10	5 16 0 0	4 19 2 6	2 7 2 0	5 2 2 0	7 5 0 6
P7 ... ... 3 " "	7 15 1 12	....	5 3 3 0	3 11 3 14	3 3 3 0	....	7 19 2 7
Superphosphate 3 cwt. ..	6 19 1 4	7 14 0 0	5 11 1 14	5 18 1 6	2 9 2 0	3 16 2 0	7 5 3 9
Basic super., 2 " "	6 10 2 22	6 19 2 0	4 11 1 0	5 0 1 22	3 5 0 0	4 7 1 0	7 10 1 7
No manure	2 6 0 8	6 17 3 0	4 16 0 0	2 4 0 18	2 5 0 0	3 15 2 0	6 19 1 20
P6 ... ... 3 cwt. per acre	....	6 15 3 9	....	....	....	4 14 0 0	....
Superphosphate 2 " ..	....	....	....	5 16 0 8	....	....	7 13 2 5
Greatest increase due to fertiliser	6 3 0 24	1 19 1 0	2 2 1 0	4 5 1 6	1 6 1 0	1 7 0 0	1 0 0 15
Cost of applying highest yielding fertiliser per acre ...	£ s. d. 2 15 0	£ s. d. 2 5 0	£ s. d. 2 15 0	£ s. d. 2 6 3	£ s. d. 2 3 0	£ s. d. 2 0 0	£ s. d. 1 18 0
Nett increased return at £5 per ton	28 1 0	7 11 3	7 16 3	19 0 0	4 8 3	4 15 0	3 2 0

The mixture P5 consists of superphosphate 4 parts, sulphate of potash 1 part; P6 of bonedust 3 parts, superphosphate 1 part, muriate of potash 1 part; P7 of equal parts of superphosphate and bonedust; P8 of equal parts of superphosphate and blood and bone.

Nana Glen.—Soil, light alluvial loam; site, bank of Orara River; practically new ground; ploughed first in summer 1917, cropped to oats in the autumn and maize in the spring, followed by oats early in autumn of 1920. The potatoes were sown on 31st August and 1st September, in rows 2 ft. 9 in. apart; seed obtained from Dorrigo. After-cultivation of plots consisted of harrowing on 8th September, scuffling on 5th October, hilling 20th October. Season exceedingly favourable, and the growth of top luxuriant. Harvesting eventuated on 21st and 22nd December; the yields were exceptionally good and high for the locality. The percentage of unmarketable tubers was very light in these trials, Up-to-date being highest at 6 per cent., Early Manistee 5 per cent., and all others less than 2½ per cent. That the high yields in the variety trial were largely due to the application of P7 fertiliser at 3 cwt. to the acre is evidenced in the trial with fertilisers. This was made with Up-to-date, two plots without manure being planted for purposes of comparison. Right from the start the unmanured plots were exceedingly backward, and only averaged at harvest 2 tons 6 cwt. 0 qrs. 8 lb. to the acre of marketable tubers, 23½ per cent. being unmarketable. An application of 5 cwt. superphosphate gave an increase over this yield of 6 tons 3 cwt. 0 qrs. 24 lb., only 2½ per cent. being undersized. All manures gave substantial increases, the lowest being basic superphosphate at 2 cwt., which yielded 6 tons 10 cwt. 2 qrs. 22 lb., 9 per cent. being unmarketable.

It is abundantly evident that fertilisers are very necessary on similar sorts in this locality, and that heavy applications are desirable. The addition of organic matter by green manuring and ploughing in of all rubbish is also recommended.

Grafton.—Alluvial loam, typical of Clarence River; previous crop, maize. Ground ploughed twice, tubers ploughed in 2 ft. 6 in. apart and 15 inches in the rows. Soil moist and in good tilth, rolled after planting and harrowed twice before and once just after coming through the ground. Planted on 7th and 8th August; variety trial fertilised with 3 cwt. superphosphate and Manhattan employed in the manurial trial. Germination satisfactory and subsequent growth excellent. The season was one of the best for years, for although August was rainless, winter rains had been heavy and the soil was in a moist condition. The plots were harvested first week in December, Manhattan proving the highest yielding of the seven varieties tested. Second place was occupied by Factor, but nearly 2 tons to the acre lighter. The manurial trial showed an increase of a ton over unmanured, with 3 cwt. of P7, which also gave the highest return in last season's experiments. The behaviour of plots fertilised with superphosphate is rather remarkable in this experiment. It would appear that the heavier the dressing the lighter the yield—an application of 5 cwt. to the acre actually resulting in slightly less than no manure. This has not been the case in previous trials, and subsequent experiments may show it to be a result of climatic, rather than of soil conditions.

Lawrence.—Experiments in this locality were sown in different paddocks; manurial trial was on new ground first broken up 15th January, 1920, cross-ploughed 5th March, and rolled and harrowed several times after each ploughing; sown with maize for fodder 9th March: soiled during May; ploughed 7th July: reploughed 9th August, and planted on 11th. The variety trial was sown in an old cultivation paddock; previous crop, maize; ploughed 6th April, reploughed 5th August, harrowed several times after each ploughing and sown 10th August. Soil in both cases, sandy loam, drills 2 ft. 7 in. apart. After cultivation harrowed 28th August; scuffled 15th and 27th September, and hilled 28th September. The season was excellent, 11·97 inches of rain falling up to 11th November. Any further rain was too late to benefit the crop.

The difference between the yield of the manurial and variety trials is mainly due to the former being on new ground. Manhattan, which is largely grown by farmers in the locality, was inferior to Brownell's Beauty and Up-to-date. In the fertiliser trials an increase of nearly 2 tons resulted from the application of 5 cwt. superphosphate, which gave the highest yield for the locality.

Mullumbimby.—Soil, red volcanic; previous crop, oats unmanured: preparation good, soil in fair tilth: planted 23rd August in rows 2 ft. 9 in. apart. Experiment consisted of trial of nine varieties. Germination of all good, except Satisfaction, Early Manistee and Dalhousie which came up badly, particularly the two latter, the yields of which were not taken: growth of top luxuriant; tubers of Up-to-date and Satisfaction were small. Season satisfactory, 12·51 inches of rain being exceptionally evenly distributed over the growing period.

It would appear from the result of this first season's trial that Factor and Brownell's Beauty are the most suitable varieties for the locality.

Condong.—Soil, alluvial, typical of Tweed River: previous crop, maize: ploughed 1st July; reploughed 10th August; harrowed and rolled after last ploughing; sown 17th and 18th August, in drills 2 ft. 9 in. apart: sets 15 inches apart. Germination satisfactory. The season was very good, the effective rainfall being 13·42 inches. The after-cultivation of the crop consisted of: harrowed, 17th September: scuffled, 24th September: hilled 2nd October. Harvesting took place on 13th and 14th December. The manurial trial, sown with Brownell's Beauty, demonstrated the value of fertilisers, all showing increased yields, the highest being 1 ton 7 cwt. with P8, which consists of equal parts of superphosphate and bone and blood, and which does not usually give such good results with potatoes. The only previous experiments in this locality were planted in the 1917–18 season, and were unfortunately ruined by flood waters in November, 1917. No data is available other than this season's experiments, and the result of future trials is necessary before definite recommendations can be made.

Tatham.—Soil, heavy alluvial, typical of best soils of Richmond River: previous crop, maize; stalks chopped and ploughed in May; second ploughing

in July, and third just before planting; rolled and harrowed after each ploughing; ground moist, but rough; rolled and harrowed immediately after planting, scuffled twice, and hilled during growth. Sown 24th and 25th August. Germination satisfactory in all but Early Manistee, Brownell's Beauty and Satisfaction, in which it was uneven. The weather for the first two months was ideal, but November, with a precipitation of 8·19 inches favoured the development of Irish blight, which reduced the yields very considerably. It would appear from the variety trial that Carman No. 1 was most resistant to the disease. This variety in last season's trials generally showed hardiness under extreme drought conditions, and is apparently one that can withstand hardships. Manhattan did not yield well, the highest return being 3 tons 11 cwt. 1 qr., when manured with 5 cwt. of superphosphate to the acre.

Warrell Creek.—Soil, light alluvial; previous crop, maize; ploughed in with disc on 4th June; left rough; fallowed and ploughed on 9th August, harrowed and disc cultivated 21st September; harrowed and planted on 22nd idem. Drills, 5 inches deep, 2 ft. 9 in. apart, sets 15 inches apart. Covered with Planet Jr. implement, with side sweeps attached. Soil in excellent tilth. Season very fair, rain in January excessive. The variety trial, fertilised throughout with superphosphate 3 cwt. per acre, favoured Manhattan and Up-to-date, with only a slight difference in favour of the former. The manurial trial distinctly favoured the application of chemical fertilisers, all showing a decided improvement over the unfertilised plot This difference was apparent in the growth of haulm right from the start. On 29th October the manured portion was 12 inches high, showed a healthy green colour and thick sturdy stems, the two unmanured plots at that time being 3 inches high and of sickly appearance. Such a difference was not anticipated here as in the plots at Nana Glen, and demonstrates the extreme variations that exist even in alluvial soils.

Size of Set Experiment.

An experiment to determine the most satisfactory size of "set," was sown with Brownell's Beauty, at Condong, adjoining the fertiliser trial. Tubers were graded as follows:—"Small," about 2 oz. in weight; "medium," 5 oz.; "large," 8 oz., from which as many sets as possible were cut.

The results obtained were as follows:—

	t.	c.	q.	lb.
1. 1 oz. sets from "large" tubers	5	3	1	0
2. 1 ,, "small" ,, ...	5	0	2	0
3. 1½ ,, "large" ,, ...	4	17	2	0
4. 1½ ,, "medium" ,, ...	4	16	2	0

These yields do not vary considerably, but favour the large tuber cut into small sets. For this plot, tubers with strong and numerous eyes were employed, each cutting seven or eight sets. It would not be possible to cut

large tubers of some varieties, *e.g.*, Manhattan, and Early Manistee, in this manner, but if the waste is not great large tubers are preferable. These results, however, must not be regarded as in any way final, being for one season only.

Summary.

The results of the variety experiments this season are consistent with those obtained in previous trials, except where Irish blight was prevalent. In the majority of the centres, trials have been in progress for long enough to narrow down the most suitable varieties to two or three. In future trials these will be adopted as standards, and only new varieties will be tested in comparison. With regard to the manurial trials, the results show a remarkable consistency, with superphosphate at 5 cwt. to the acre out-yielding all others in five out of seven centres. In previous trials 3 cwt. of superphosphate was the heaviest quantity applied, but it would appear that the heavier application produces higher yields, at least in seasons when the rainfall is ample.

The chief virtue of superphosphate is its ready availability— putting within reach of the young plant soluble plant-food, and ensuring a healthy start. Although all fertilisers in these trials have given increased yields, it must be borne in mind that they will not make up deficiencies in the physical condition of the soil and thorough preparation is the first essential of profitable potato growing.

Growers must depend largely on field experiments, such as the foregoing, for accurate and specific information of comparative methods of potato growing. Particularly is this true of the necessity for applying artificial fertilisers, which cannot definitely be ascertained in any other manner. Artificial fertilisers are costly, and farmers cannot afford to apply to the soil materials which are not likely to produce a return. The experiments, while illustrating the value of fertilisers, also show what particular kinds can be economically used by the crop.

Treatment of Empty "Super" Bags to Arrest Decomposition.

Bags of any description are well worth caring for nowadays, and those that have contained superphosphate may be conserved for many other useful purposes if they are treated as follows:—Turn the empty bags inside out and thoroughly shake out all remaining superphosphate dust. Keep the bags away from wet or damp, and as early as convenient immerse them in limewater until thoroughly soaked; then drain and hang them out to dry. Wherever a bag has actually been burnt by the action of the superphosphate the effect cannot, of course, be cured, but the action is effectually stopped by the treatment described.

The limewater should be made in the same way as that used for liming wheat after pickling with bluestone, about 3 or 4 pounds of freshly slaked quicklime being used to each 10 gallons of water. The larger quantity of lime is the better, as mice will not readily attack bags so treated.

The Size of Seed in Relation to Wheat Yields.

J. T. PRIDHAM, Plant Breeder.

AN experiment to test the relation of the size of the seed to the yield in wheat was started by Dr. N. A. Cobb at Wagga Experiment Farm in 1898, when two rows of each variety were sown, the seed in one case being the largest and in the other the smallest in samples of the respective varieties grown the previous year. In 1899 the largest grains were picked from the row sown from the largest seed, and the smallest grains were taken from the produce of the row sown from the smallest seed. From year to year this practice was kept up, the grain for sowing being picked by hand from the respective lots harvested.

The results seem to show that the use of small seed does not result in any deterioration to speak of in respect to the quality and vigour of the grain but that the yields per acre are invariably low. While this may be made a strong case for grading, it should be pointed out that the smallest seed was used in the third section—grain that the harvesting machinery would remove as cracked and small chick wheat. In the light of other experiments with heavy and light or large and small seed it would appear that large and medium sized *sound* seed are about equally good for sowing. The great benefit of grading is to remove a large percentage of damaged and cracked grain, as well as small seed which might be left in the sample by ordinary harvesting machinery, together with foreign seeds and particularly oats.

Note.—The yields in 1899, 1900, and 1901 were destroyed by grain moth.

SIZE of Seed in relation to wheat yields.

Year.	Largest grain from "Large Grain" row.					Largest grain from "Small Grain" row.					Smallest grain from "Small Grain" row.				
	Allora Spring.	Hudson's Early Purple Straw.	White Velvet.	Total.		Allora Spring.	Hudson's Early Purple Straw.	White Velvet.	Total.		Allora Spring.	Hudson's Early Purple Straw.	White Velvet.	Total.	
	oz.	oz.	oz.	lb.	oz.	oz.	oz.	oz.	lb.	oz.	oz.	oz.	oz.	lb.	oz.
1902	17½	15½	19	3	4	16¾	16¾	15	3	0½	6	6	6	1	2
1903	29	25	34	5	8	29	30	32½	5	11½	18½	21	13½	3	5
1904	32	30½	28½	5	11	31½	34	30½	6	0	15½	18	18	3	3½
1905	29	28	37¾	5	14¾	23	30¾	35	5	8¾	15¾	19¾	21½	3	9
1906	33	21½	25	4	15½	35½	29½	31¼	6	0½	18¾	13	18¼	3	2
1907	14	24	15¾	3	5¾	19½	20¼	16¾	3	8½	9	11½	9¾	1	14¼
1908	35½	32¾	33	6	5¼	33¾	30¾	35¼	6	4	22	18¾	17¼	3	10
1909	22¼	32	32½	5	7	28¼	32¾	30¾	5	11¾	11	14¾	8	2	1¾
1910	78	61½	55¼	12	2¾	79	69	58½	12	14½	25¼	27½	16	4	4¾
1911	18¾	23¾	24½	4	3	20¾	20½	28¾	4	1	5½	7¾	10¼	1	7½

Producing Lucerne Hay under Irrigation Conditions.

Methods and Experiences at Yanco Experiment Farm.

[Concluded from page 564.]

F. G. CHOMLEY, Manager, and F. CHAFFEY, Farm Foreman.

A Few Remarks on Grazing Lucerne.

A GOOD deal of damage has been done to lucerne stands on the irrigation area by settlers who have grazed live stock after the hay crop is off, thinking that thereby the wisps of hay that have been left on the ground are saved. As a matter of fact, the quantity of hay so made use of is very small indeed, whereas the damage done to the stand is very considerable. Unskilful grazing will kill a stand in astonishingly quick time. Successful grazing is a business in itself, and the farmer who proposes to go in for it should do so systematically, subdividing his stand into half a dozen small plots, each of which could be grazed off by a suitable number of stock in turn, so that each block will have time to recover before it comes under stock again. In this way a careful grazer could do well with lucerne, and still preserve his stand. On the other hand, casual grazing of the whole area after each hay crop is likely to be attended with losses that far exceed all gains, for the stock in cleaning up the bit of hay left on the ground are certain also to graze the tender shoots of the next growth, and thus to delay the following cut as well as probably damage the plants.

It is important, for the sake of the stock, that animals be put on to lucerne full—not hungry—or hoven may occur, and with it serious losses among the stock. Some prevent too eager and greedy consumption by putting a bit in the mouth, and others turn the animals in for fifteen minutes and then ruthlessly turn them out before they can overfeed.

Pressing and Baling without Stacking.

From the field the hay is drawn to the yard, and unloaded straight from the waggon into a mechanical press that turns it out a properly squared, pressed, and wired bale. The implements and methods employed on the farm have already saved the cocking in the field, but here in the yard is a further important saving—the avoidance of all stacking whether in the open or in a shed. No stacking, no cutting out with the hay knife, no baling with wooden battens, and no laborious wiring, no delay for weeks in the stack before the crop can be turned into money.

Two waggons are used in carting on, so that while one is alongside the press the other is being loaded in the field, and thus a fairly continuous supply of hay is kept up to the press. The waggons used are ordinary iron-wheeled, 6-inch tired farm waggons of 5 or 6 tons burden, equipped with a

flat hay frame and a light batten frame set vertically in front, with a low sloping frame at the tail. This tail frame has the corners cut off to enable the hay loader to work in close while turning. The waggons are provided with one pair of shafts and two outriggers, one on either side; three horses are used abreast while loading, as a steady slow forward movement is essential. The load is pulled over on to the track leading to the press by the three horses; from there one horse pulls it, the other two horses remaining in the field for attachment to the next supply waggon to come out.

The hay is actually baled and prepared for market at a slightly greater cost than if it were stacked under the old method, and operations of cutting and baling from the stack, necessary under the old system at a cost of 12s. to 15s. per ton, are entirely saved.

The Derrick Hay Press at Work.

The hay is pressed and baled direct from the waggon.

Moreover, the old method was attended by a delay of weeks between carting in and marketing, whereas the machinery now in operation on the farm enables the hay to be marketed at once if the ruling price is attractive, or will permit it to be held in bales until the market is favourable, when it can be forwarded at once, all that is necessary being to cart it to the station. Even if the hay is only to be stored and fed to the farm stock when feed is scarce, it is an appreciable advantage to have the fodder in a convenient form in which it can be fed into the troughs and carted to the paddocks without any forking, and at no greater cost than a slight increase on the old method of stacking.

Some saving is represented, too, in the fact that if the hay has to be kept on hand it takes up only one-third of the space in bales that it would require in a shed or stack, it can be easily and quickly stacked and comparatively cheaply protected from the weather, and it will keep indefinitely.

The mechanical press that enables all this to be accomplished is illustrated in the accompanying blocks.

It consists of a derrick press, operated by any suitable power such as horse, steam, electricity, or combustion engine. From the dray or waggon the hay is forked to a platform where a second man directs it towards the press, which automatically feeds itself, drawing the material forward and folding it into layers in which it is moved forward into the press proper. There it is wired by two men, one of whom also carries the bales away. No. 14 soft black wire is used for the purpose, two wires being placed round each bale; the outlay on wire is almost trivial, for one coil presses about 12 tons, according to the quality of the hay. The finished bales are stacked by a fifth man when necessary. The bales, averaging about 90 lb. each, come away with mechanical regularity, and where once it required two men to be thoroughly expert to bale 3 tons per day, it is now possible with four or five men with no particular training to press and bale 14 tons per

Lucerne Hay ready for the Road.

day. The present plant owes some of its speed, of course, to the use of motor power (an oil engine), but with horse-power 8 tons per day have been pressed on the farm.

One stands beside this press with the reflection that yesterday this lucerne was a standing crop; to-morrow it will be on its way to Sydney.

When the new bales without the familiar wooden battens and the usual trimly-cut sides appeared on the Sussex-street market, they were viewed with some hesitation by buyers, but the prejudice gradually diminished and on occasions the derrick-pressed hay has actually topped the market. Some objection was offered at first, on the ground that the leaf was lost in hay pressed in this way, but that was when the hay was being pressed from the stack. Now that the hay is pressed direct from the field, and the operation of stacking is cut out the loss of leaf is far smaller, and the quality of the hay is correspondingly better.

To harvest, cure, bale, and truck seven cuts of hay per season from 120 acres looks a formidable matter, but it is accomplished by eight men in average working hours, and without any great pressure at any stage. Were it stacked in the ordinary way the same staff would be required, and to press and bale the crop as a subsequent operation would require further labour.

The last cut of the season being off (usually in May), all well-established stands of lucerne are cultivated with a thirteen-tooth cultivator. Six horses are required to operate the implement, which is always worked in the direction of the drill and the fall of the land. The tines are set firm, and when they strike a row of lucerne, instead of running along on the tops and injuring the plants, the implement moves laterally and the tines again run between the rows.

Following this, either in the early winter or in the spring the whole lucerne paddock is top-dressed with 2 cwt. superphosphate. Experiments are being conducted on the farm to determine the exact quantities that should be used, and the exact time (winter or spring). In the meantime the quantity mentioned can be recommended, and on the whole the early spring appears to be most effective.

At the same time, the convenience of the farm may be considered to the extent of making the application in the winter.

The final operation consists of a cross-harrowing, the object of which is to break up the clods and to level the ground again for the mower. The maintenance of the check banks must always be kept in view, of course.

Well established and well treated, a stand of lucerne in this district should last six or seven years at least. At the present time there is one paddock on this farm that is carrying 7-year-old lucerne, and it is as good as when it was 3 years old.

Yields.

It is only natural to expect that the yield per acre will depend upon the nature of the soil. As already stated, the soil on the experiment farm varies considerably, and while some patches grow luxuriantly (as shown in the illustrations) some are on the light side. The seven cuts taken in the season 1919-20 yielded an average of 6 tons 12 cwt. of baled hay per acre over the whole 120 acres in cultivation, which is slightly less than 1 ton per cut per acre. Owing to cooler weather and delays due to wet weather in the spring, the yield for the season 1920-21 was a little less. It would be safe, however, to count upon 5 tons of hay per acre per annum under normal conditions with average care.

A Prolific Sow.

Mr. S. W. Gardner, Springs Delight, Comboyne, writes :—" I have a Tamworth-Berkshire sow which, in eight litters, has yielded me 123 pigs."

The Cause of Black Disease and its Method of Transmission.

Being Further Studies in a Braxy-like Disease of Sheep.

[Concluded from page 574.]

SYDNEY DODD, D.V.Sc., F.R.C.V.S., Lecturer in Veterinary Pathology and Bacteriology, Veterinary School, The University of Sydney.

Immunisation.

After the determination of the causal agent it was a natural sequence to endeavour to devise a method of prevention against black disease. Curative treatment, in view of the acuteness of the disease and the conditions under which sheep are kept in Australia, is impracticable. One aspect of prevention has already been dealt with, viz., the rendering of the moist areas unsuitable breeding-grounds for the intermediate host of the fluke (the water snail) by drainage. If this is not practicable such areas could be fenced off. The question of preventive vaccination has been considered, and an attenuated vaccine prepared. It was first tried on small animals, then on sheep, at the laboratory. About sixty of the latter, in batches of three or four, were vaccinated at various periods, and apparently the immunisation was efficacious, as the animals subsequently resisted fatal amounts of virulent bacilli. No reaction to the latter appeared at times, and a moderate local tumifaction developed at others, if a large dose (for example, 3-5 c.cs. of virulent culture) were injected. There were no deaths.

This success determined me to try the value of preventive vaccination in the field. During the seasons 1918-19 and 1919-20 between 5,000 and 6,000 sheep were vaccinated (about 2,600 each season), at such a period as would permit the immunity to be fully established before the onset of black disease. The animals were placed in two notoriously infected paddocks where the annual loss for years had been from 20 to 30 per cent., and several hundred unvaccinated sheep of the same age, sex, &c., were placed with them as controls. The results have been not altogether expected. If the vaccination were unsuccessful one would expect both vaccinated and control sheep to die in the same proportion, whereas if it were successful, only the control sheep should die in any number. As a matter of fact, during both seasons the mortality in these paddocks from all causes was not more than 2·5 per cent., and there was the same low percentage of deaths in the controls as in the vaccinated animals. As remarked, this tremendous reduction of the average mortality from black disease was not expected to be seen in the unprotected as well as the protected animals, and although the owner (who informed me that he had known the particular station for twenty-six years and in one of the experimental paddocks the mortality averaged 25 to 30 per cent. each season), was satisfied so far as losses were concerned, it did not solve the question as to whether the

vaccine was efficacious in the prevention of black disease. I think the real explanation of the great drop in the incidence of the disease in the particular paddocks is that the owner during the summer preceding the vaccination, had thoroughly drained the swampy places, so that the water from the springs could readily get away, and consequently the carriers of the disease had disappeared to a great extent.

Experimental vaccination can be carried out in the laboratory at any time of the year, but the real test of the value of such work lies in its application in the field on a large scale, and, owing to the seasonal character of black disease, this can only be carried out once a year, because no matter when the immunisation was made, one would have to wait until the end of the black disease season before any conclusions could be drawn as to its efficacy. If it were unsuccessful for any reason, then one would have to wait another year before undertaking a fresh series of field experiments on a large scale. It follows that such work cannot be accomplished quickly.

The research work in general has been prolonged for a variety of reasons; the strictly seasonal character of the disease (February to May being the usual period), the distance from Sydney (more than 300 miles to the locality of the disease), and the writer being engaged in teaching duties as well as carrying out bacteriological and pathological work for the State at the same time. Perhaps what has handicapped one most of all is the total absence of skilled technical assistance, all work, whether in the laboratory or the field, having in this respect to be carried out unaided. Those who have had to do with the preparation of culture media, cultures, sections, &c., will appreciate what this means. Finally, in view of the pitfalls which other workers have fallen into, it was very desirable that one should take more than usual precautions in order not to make the same or other errors.

The identity or non-identity of Black Disease with the Braxy-like disease of Sheep in Victoria and Tasmania, and Braxy or Bradsot.

It has not yet been established that the above diseases are identical. Several statements in the affirmative have been made, but these are merely opinions, and a definite decision as to whether the diseases are the same or not can only be arrived at by a comparison of the causal organisms, when the latter have been conclusively proved to be the etiological factor of each condition. In the meantime, however, one may express an opinion as to the probabilities, based on one's own experience and on the published work of others.

The evidence for the identity of black disease and the braxy-like disease in Tasmania and Victoria is very strong, save that the organism claimed by Gilruth to be the causal factor of the latter, is not the same as that responsible for black disease. On referring to his account of his investigations* one finds the following remarks *re* the disease in Victoria (page 570): "The soil is not rich . . . it is fairly watered by means of springs . . . which generally result in the formation of a small swampy area

* Proceedings of the Australasian Association for the Advancement of Science, 1911, vol. 13.

around each. As a consequence, fluke disease is common." Concerning post-mortem appearances he notes among other changes (page 571) "The stomach is always more or less deeply congested, but I have observed no ulceration. *The liver often presents a mottled appearance, due to circumscribed irregular areas of necrosis.*"

As regards the pathogenic organism, he describes what he considers to be the characteristic organism as being present in the effusions, organs, and even in the blood itself, but never in a state of purity. He further adds (page 572): "*The necrosed liver areas also show the characteristic bacilli in great numbers.*"

Regarding the disease in Tasmania, he says (page 570): "The liver is very often congested, *and may show yellowish necrotic areas.*"

The italics in the foregoing quotations are mine.

It is evident that the necrotic hepatic lesions were looked upon as secondary in character, for no experimental work appears to have been done with them. The materials for animal inoculation being blood and exudates, it follows that the bacilli he saw in sections of hepatic necrotic lesions were not necessarily identical with those obtained from the blood and exudates of the same animal or animals, in view of my own experiences.

The indications are pretty clear that black disease in New South Wales and the braxy-like disease in Victoria and Tasmania are identical. Now, seeing that Gilruth definitely claimed to have isolated the causal organism of the latter disease, it is evident that it should be identical with that isolated from black disease. I have had opportunity of examining two different lots of material containing the bacilli isolated by Gilruth, and find that they are not the same, either morphologically or culturally, as those isolated from cases of black disease. This being the case, one has to explain the difference. Reference to my first article will show that in the early period of the investigations my results agreed with those of Gilruth bacteriologically, but it was subsequently shown that the bacilli that had been isolated from sheep found dead, although death had only recently taken place, could not be acknowledged the indisputable cause of the disease. Later on it was shown that they were agonal or post-mortem invaders, as proved by their absence from blood, tissues, &c., when such were removed immediately the animal had been *seen to die*. On reading Gilruth's articles one cannot avoid the conclusion that the same thing happened in the case of the Victorian and Tasmanian investigations, viz., that the bacteria claimed to be the causal organisms were obtained from animals from which the possibilities of post-mortem invasion could not be excluded.

Regarding the identity of the Australian disease with European braxy or bradsot, the matter is more difficult to approach. The bacteriological findings of a number of writers afford little aid in the solution of the question. Some were undoubtedly dealing with post-mortem invaders, whilst others had not eliminated that possibility. As regards the disease seen on the continent of Europe, there is still dispute as to the etiological factor. Here again some of the writers were undoubtedly working with cadaver

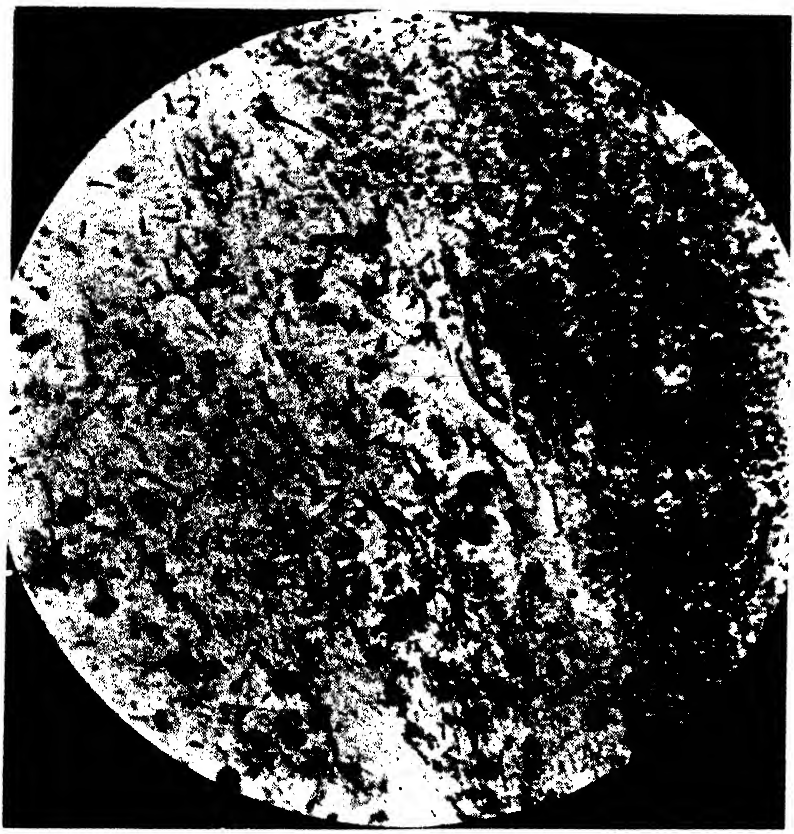
bacilli. It would greatly simplify matters if it could be shown that whatever bacilli were isolated, they were obtained from animals immediately they were dead, and that means were taken to prevent any secondary contamination of the fluids or tissues, this being an important consideration. In spite of these uncertainties it would appear that braxy or bradsot have a number of features in common as regards climatology and morbid anatomy, if one disregards the obvious post-mortem phenomena in connection with the latter; but (and this I consider to be an important difference) I have not been able to discover any reference to the presence of liver lesions in descriptions of the disease either in Great Britain or on the Continent. If these are really absent, then one must conclude that either the disease is not identical with that seen in Australia, or that the port of entrance of the bacilli is not the same, and that the carrier can therefore hardly be the liver fluke. On the other hand it may be that the liver lesion or lesions have been overlooked by those making the examination, or they have been viewed as merely of secondary importance, and attention has been directed elsewhere, as, for example, to the abomasum. It will be evident that microscopical examination of, or cultures made from, any portion of the liver, save from the necrotic foci themselves, would be entirely negative if means were taken to avoid agonal or post-mortem invasion. The fact that a bacillus, which has been isolated from blood, exudates, or organs of sheep found dead, is very fatal to experimental animals upon parenteral inoculation, is no proof that it was the causal agent of the disease, because it is well known that quite a number of anaerobic cadaver bacilli are highly pathogenic when so injected.

It is rather strange that, although investigators have known of the fallacies introduced by working with cadaver bacilli, yet until the writer pointed it out, no one working on braxy or its allies appears to have realised the primary importance of the fact that in research work on diseases of this nature in sheep, one should always be assured that the organisms isolated were present in the body (in the strict sense of the word) before death, unless it can be shown that invasion of the body itself is not necessary for the organism to produce its pathogenic effects. Of course, it has to be admitted at once that if the fluke is capable of acting as a mechanical carrier of one species of bacterium to the liver, there is no reason why other species may not be so transmitted, given the opportunity. The writer therefore hopes that this aspect of the method of infection in the type of disease discussed in the present article may be given consideration by workers on braxy and bradsot, and also in the condition met with in various parts of Australia and elsewhere, in order that the writer's hypothesis may in their particular cases be either established or disproved.

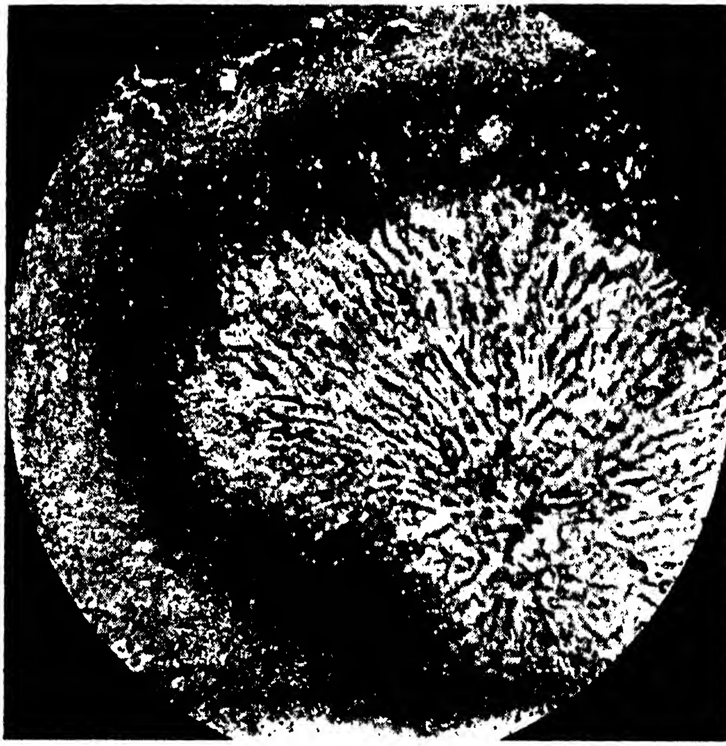
Summary.

Black disease is a condition apparently peculiar to sheep, and seasonal in occurrence.

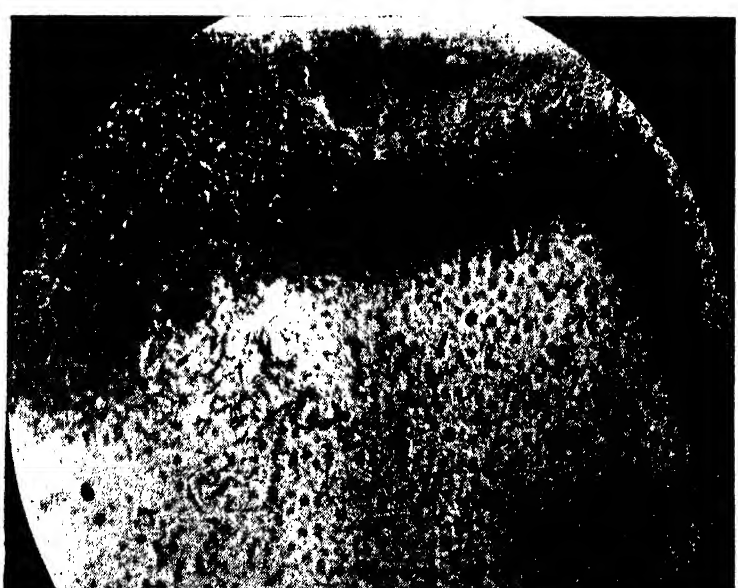
It is a toxæmia, running an acute course. The primary lesions are situated in the liver, and consist of circumscribed areas of necrosis. One or several lesions may be present.



Section liver lesion, Case 53, stained claudius; showing necrotic area and zone of leucocytes, the bacilli being grouped in masses around the periphery, and also scattered throughout t.e necroti portion. Obj: 6 m.m. No. 2 Oc: 55 c.m. x 400.

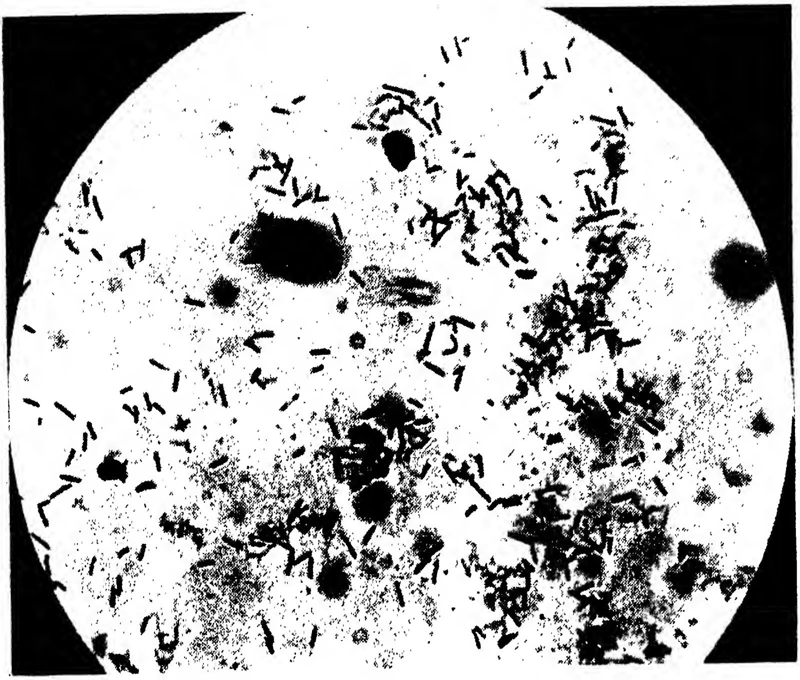


Section of liver lesion, from Case 53, stained hæmatoxylin and eosin; showing central necrotic area surrounded by dense zone of leucocytes; outside this is normal liver tissue. Ob: 16 m.m. Oc: 2. 55 c.m. x 145.

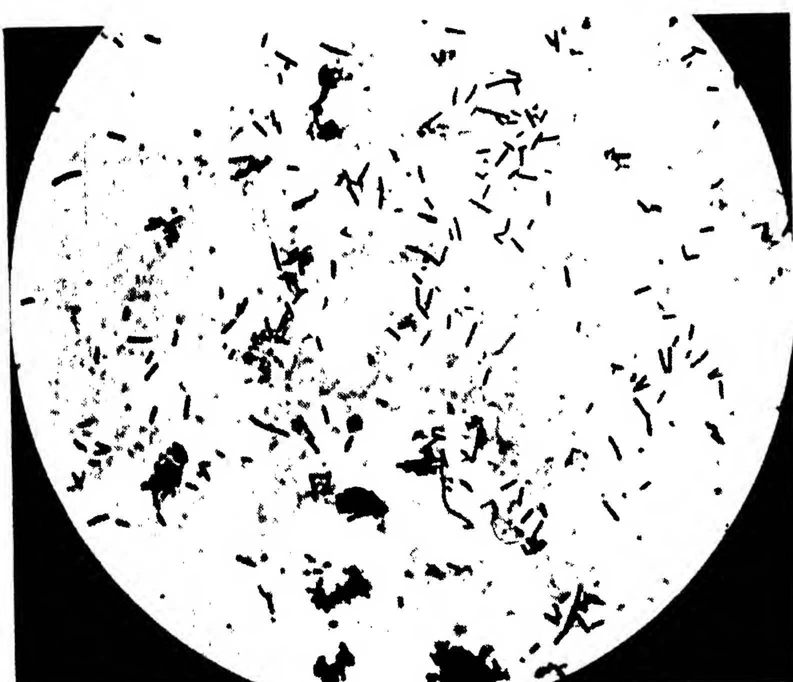


Section of necrotic liver lesion, Case 52, stained claudius and hæmatoxylin; showing large necrotic area, with masses of bacilli grouped around the periphery and individual bacilli scattered throughout the body of the lesion; also zone of leucocytes, and immediately beyond that normal liver tissue. Obj: 16 m.m. Oc: 2. 55 c.m. x 145.

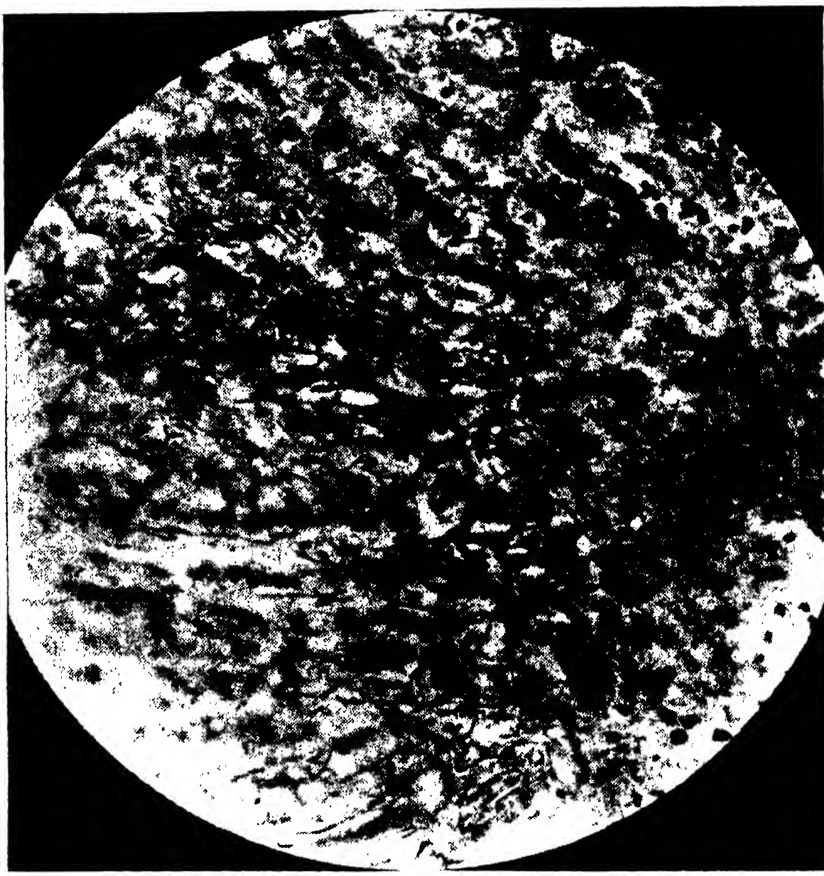
Photographs by R. Grant.



Culture from hepatic necrotic focus, Case 30, twenty-four hours liver piece broth; claudius stain. Obj: 6 m.m. Oc: 2. 55 c.m. x 400.



Twenty-four hours liver piece broth culture from subcutaneous exudate, guinea pig 147; claudius stain. Obj. 6 m.m. Oc: 2. 55 c.m. x 400.



Portion of necrotic area in hepatic lesion, Case 52 ; showing the filamentous character of the massed bacilli ; claudius stain. Obj : 6 m.m. Oc : 2. 55 c.m. x 400.

Other lesions seen elsewhere must be looked upon as secondary and probably due to the action of the toxin produced by the bacilli in the primary lesion and distributed in the blood stream.

The primary hepatic lesions contain the causal organism, which at the time of death are confined thereto and cannot be demonstrated elsewhere even in the liver, save for a few exceptional occasions in which no gross necrotic foci were seen but the bacilli were found to be present in that organ. Such cases may be looked upon as ones of mass infection, the defences of the organ having been overwhelmed before they could come into action.

The causal organism is one of the larger anaerobic bacilli, which sporulates readily, and is probably a facultative parasite.

Experimental inoculation of virulent cultures is fatal to sheep and other animals, and the lesions are anatomically those of black disease, the apparent difference being due to the port of entrance of the bacilli and the nature of the tissues there. (Compare contagious bovine pleuro-pneumonia.)

The situation of the primary lesion or lesions, and the failure to infect by feeding experiments with virulent cultures or viscera of affected animals, suggests the probability of a carrier, and the seasonal character of the disease, the geographical features of infected paddocks and the presence of fluke disease, indicates that the liver fluke is the mechanical carrier.

Black disease is probably identical with the braxy-like diseases in Tasmania and Victoria, although the organism claimed to be the cause of the latter is not identical with that isolated from the former. Until more definite information is obtainable regarding braxy or bradsot, in which the possibility of post-mortem invasion has been eliminated, it is not possible to decide whether the European disease is the same as that seen in Australia. It is, however, quite probable that it is.

[The accompanying photographs are by Mr. R. Grant, Bureau of Microbiology.]

The Uses of Sulphur.

Sulphur enters very largely into the composition of plants, and most soils contain it in only limited quantities, so that at first sight it would appear that its application should have a beneficial effect on growth. This would probably be the case were it not for the fact that the atmosphere contains quite an appreciable quantity of sulphur, some of which is carried to the soil in the rain. Many fertilisers, particularly superphosphate, contain a fair amount of sulphur. These various sources provide sufficient for the needs of most plants

While in some cases the application of sulphur to the soil in this State has apparently stimulated growth, as a general rule it has made no appreciable difference.

Sulphur is an extremely useful fungicide, and is largely used in the control of fungus diseases, particularly those which affect fruit trees and grape vines. Its value in this direction led the Department to experiment with it for the treatment of smut in wheat, but it has proved unsatisfactory for the purpose.—A. H. E. McDonald, Chief Inspector of Agriculture.

The Pre-soak Method of Treating Seed Wheat for Bunt.

The dipping of seed wheat in copper sulphate (bluestone) or in formalin, as recommended for the treatment of bunt, is accompanied by a reduced and retarded germination. As a result of his investigations, Mr. H. Braun, of the U.S. Department of Agriculture, came to the conclusion (*Journal of Agricultural Research*, July, 1920) that the adoption of what he terms the pre-soak method largely or entirely removes these drawbacks.

The pre-soak method consists of dipping the seed in water for ten minutes at, say, 6 a.m., and then draining and covering with bags for six hours. At noon the seed is treated in the ordinary way with copper sulphate or formalin, drained and again covered for six hours. At 6 p.m. the seed is spread out to dry over night, and is ready for sowing the next morning.

To test the value of this method a series of experiments was carried out at Hawkesbury Agricultural College with a sample of Hard Federation wheat. from which all small and obviously broken seeds has been removed by hand. The dipping solutions used were (1) that recommended by this Department, namely, 1¼ lb. copper sulphate to 10 gallons water, followed by dipping in lime water, and (2) formalin, 1 lb. to 40 gallons of water. Tests were made with these solutions both by the ordinary and the pre-soak methods. All seeds that floated were removed.

The results of the experiments with seeds sown in moist soil and in dry soil one week before watering, may be summarised as follows :—

Slight improvements were found in germination and germination-speed when the pre-soak method was used with copper sulphate, as against the ordinary method.

No improvement resulted from the use of this method with formalin.

Owing to the extra work the pre-soak system involves, the results obtained do not justify its adoption with copper sulphate. With formalin its use appears detrimental.—W. M. Carne, Lecturer in Botany, Hawkesbury Agricultural College.

An Affection of the Mouths of Sheep.

"The animals affected have swollen nostrils and mouth, more than twice their ordinary size, and they are practically unable to eat. The general opinion throughout the district is that it is caused by eating the black thistle, but as there is a distinctly bad smell from the nostrils and they are mostly smeared with blood, it occurred to me it might be a disease."

The reply to a letter in such terms from the central western district, stated that such conditions are not uncommon when animals are feeding among prickly vegetation. The small wounds so caused are likely to become infected with organisms of various types, particularly if any of those which cause necrosis are present in the paddocks. If it is possible, the sheep should be moved from the paddock in which they became infected; the affected ones should be picked out and kept in a handy place where water and soft food are available, and the mouths and nostrils dressed with a solution of condy's crystals in water. The solution should be a fairly deep red colour. If a small syringe is available, a little of the solution could be syringed into the nostrils, but this should not be over-done, or some may be forced into the lungs.—S. T. D. Symons, Chief Inspector of Stock.

The Value of Soil Analyses to the Farmer.

F. B. GUTHRIE AND R. M. PETRIE.

THERE is, and always has been, much difference of opinion regarding the value to the farmer of an examination of his soil. On the one hand, the view has been expressed that the chemical composition of the soil is a reliable guide to the nature of the manuring required. On the other hand, opinions equally emphatic have been voiced that an examination of the soil (usually called soil analysis) is not only of no value but positively misleading.

The trouble is probably due to the use of the term "soil analysis" and the different interpretations placed upon it. Those who believe that an analysis of the soil consisting only of the determination of the chemical plant-food is no guide to the manurial requirements of the soil are perfectly correct. This view of the matter was expressed by one of us (F.B.G.) as long ago as 1895, when, in an address before the Australasian Association for the Advancement of Science in Brisbane, it was pointed out that an examination of a soil, to be of any benefit to the farmer, should take into account the texture of the soil, its behaviour towards water, &c., thereby suggesting means by which any defects might be ameliorated, and by which the soil might be brought into the most fertile condition possible and into such a state that it could utilise to the best advantage any manures added.

This fact has been borne in mind in connection with soil examinations carried out by the Chemist's Branch of the Department ever since, and recommendations for manuring are never based on the quantities of nitrogen, potash, and phosphoric acid present in the soil. In fact, determinations as to quantities of these constituents are seldom made, and only in cases where the applicant expressly desires such information, or where the information is required for such scientific purposes as fixing different soil types, or for our own information. Out of 246 soils examined during the last twelve months, these determinations have only been made in twenty one cases. Manures are recommended as the result of departmental experience with the different crops in different districts.

The examination of soils as conducted by this branch of the Department is more in the nature of an investigation than an analysis, the object being to reveal to the farmer the defects in his soil, such as sourness, stiffness, presence of plant poisons, lack of humus (organic matter), or of lime, &c., and to advise as to proper treatment, in order that benefit may be derived from subsequent manuring. Such a soil analysis is of value in determining changes which take place in the soil under certain conditions, and in comparing one soil with another, all of which work assists in the study of the effect of changing the physical condition and the effect of cropping. The knowledge so obtained can later be practically applied to help the farmer to obtain better and larger crops.

The usefulness of a laboratory examination (so-called analysis) of a soil lies in the indications it affords as to sourness, alkalinity, presence of excess of salt, poor water-holding power, lack of humus, lack of lime, need for drainage, imperviousness to the passage of water, tendency to set hard on drying, presence of hard-pan, presence of toxic substances, suitability to different crops, general poverty in plant-food, excessive proportion of any ingredient such as clay, sand, peat, or stone, and power of nitrification.

The determination of the percentage amounts of the plant-foods nitrogen, phosphoric acid, and potash does not afford any information under the above important headings, is in any case a process too laborious to be carried out invariably, and is only made in the exceptional cases mentioned previously. It is no guide whatever as to the nature of any necessary manuring, which depends in the first place on the nature of the crop, and (in a lesser degree) on the district and the climate. Neither is it any guide as to the suitability of the soil for different crops.

Soil examinations on the rational lines described, and as carried out by this branch, should always precede recommendations for manuring, as it would be quite idle to expect manures to exercise any benefit on soils possessing some of the physical defects enumerated. That such an examination is of value is evidenced by the very considerable number of soils forwarded for examination.

It is a matter for regret that there is no soil survey branch of the Department of Agriculture in this State as in other countries. Such a branch could establish type-soils in different districts, and refer soils under examination to one or other of such types, the characteristics of which had been previously established. Such surveys would be of very great advantage in determining the nature of the different soils in areas to be subdivided into farms, and in valuing the soil from the point of view of its agricultural possibilities. All such subdivisions should be preceded by a soil survey properly carried out.

Seedling Oranges, Sixty-Four Years Old.

Mr. H. Malcolm Findlay, Arcadia, *via* Hornsby, forwards particulars of some orange trees sixty-four years old, with the comment that in view of the fact that the trees were seedlings the details might be of interest to other orchardists. The trees were planted on 12th November, 1857, and after being worked for twelve years were deserted, the fence surrounding them being broken down and burnt by bush fires. After a lapse of fifteen years the trees were re-worked and cared for up to six years ago, when they were neglected again Last year they were worked again, and sprayed for wax and louse in February with a spray made up of 5 lb. soda, 1 gallon miscible oil, and 40 gallons water. This year the trees made new growth of 6 to 9 inches, making their present height 20 feet, and the diameter near the ground 17 feet. They carried six to seven cases of oranges, and in years gone by always pulled ten to fourteen bushel cases. The present state of the trees is perfectly sound. The fruit, except for what grows on the top, is more or less marked with maori and melanose, but the flavour is excellent.—W. J. Allen.

Methods of Maize Breeding for Increase of Yield.*

H. WENHOLZ, B.Sc. (Agr.), Inspector of Agriculture.

PROBABLY over 90 per cent. of the maize-growers in Australia select their seed maize in the barn at husking time, with little or no accurate knowledge of any definite relation of type of ear to yielding capacity. A comparatively small number of progressive growers select their seed in the field before or at harvesting time, and thereby effect some improvement in yield if they do it with care, and very few farmers indeed work on a reliable system of breeding by which yields can be definitely increased.

Much work has been done in America to show that there is little or no correlation between type of ear and yield, but these results have lately been questioned on account of the known suitability of certain types of maize to regions differing markedly in climatic conditions. In New South Wales a vast amount of evidence is being collected to determine what ear characters, if any, are correlated with yield for particular varieties which have become well established in different districts on account of their high yielding capabilities. The work of some experienced growers in selecting to a certain type over a long period of years, and in evolving thereby a fairly well fixed type which outyields other varieties of different type on their own farms, suggests that there is some kind of broad correlation between type and yield for a particular locality, or for a definite set of local conditions. The fact that many of these long continued selections have resulted also in repeated prize winnings at local agricultural shows suggests that there is some relation between show points and yield in well-established types in a locality.

In view of the repeated proof of lack of vigour and diminution in yield resulting from self-fertilisation or close fertilisation in maize, it would seem that distinctive varieties, like Boone County White and Reid's Yellow Dent particularly, which are American varieties of high uniformity and with good show points, are of too homozygous condition to be high yielding, but this is not the case.

In spite of the vigour derived from coupling heterozygous characters, such as would be possessed by different types as generally accepted, it appears then, as if there is some maintenance or improvement in yielding capacity by the long continued selection of a certain type of maize for certain local

*Paper read before the Agricultural Section of the Australasian Association for the Advancement of Science, Hobart, 1921.

conditions. If this is correct, the only objection to improving a variety of maize in yielding capacity by this means of simple selection is the long time necessary to get this well-established type.

To begin with a variety of maize consisting of a number of somewhat different types is to take many years to evolve a well fixed type, and to begin with a fairly well fixed type is to risk the unsuitability of the type to local conditions.

With a uniform strain or variety of maize which yields well in a district, selection of ears of the true variety type will probably do all that is necessary in at least maintaining or perhaps slightly increasing its yielding capacity. In such circumstances the ear-row system of breeding a variety of maize does not offer much hope of effecting any marked increase in yield. This is explained by the fact that where great uniformity exists it does not make for very great differences in the yields of individual ears (such as are obtained in a variety of maize which contains many types), and therefore no easy elimination of poor yielding ears can take place.

At the present time, however, very few varieties of maize in Australia are in such a state that they do not show marked differences in type of ears, which differ in yielding capacity when submitted to the ear-row test. Uniformity within the variety has been brought to a high standard by American breeders in some varieties, and the ear-row test in such cases is being found to be of less value in increasing the yield of a variety of maize, and other methods are now being sought.

Before passing on to a brief description of these methods, there is something to be said in favour of field selection of seed, which has been shown to be a very profitable practice. There is little doubt about the advantage of selecting seed maize in the field over picking the seed ears in the barn, but the method which is considered to affect the yield more than any other is the application of the old principle of the "survival of the fittest"—in other words, the selection of ears from those stalks which grew in a full "hill," and which were surrounded by a full stand (growing under competition), the ears being up to or above standard weight and size. This is the ideal to aim at in the field selection of seed maize. Increases of from 5 to 7 bushels per acre have been made in New South Wales from field-selected seed over barn-selected seed.

For the foundation of any seed maize plot, then, the field-selected ears are most desirable, and this practice could be more largely undertaken by maize-growers with profit.

As stated before, in many cases (especially where varieties have been subjected to selection for uniformity of type for many years) the efficacy of the ear-row test for improving the yield is now being questioned in America.

A brief description of the ear-row method of breeding maize will not be out of place here. A number of ears are selected and rows of equal length about 2 or 3 chains long are planted from each ear at the same rate of sowing. As it takes only a small portion of each ear to plant a row, the

remnant ears are carefully kept till the following year, when the residues of the highest yielding ears, as determined by this test, are sown in a separate plot (breeding plot). This lays the foundation for an improved yielding strain of seed of the variety.

The chief objections which have lately been raised to the ear-row test in America are as follows :—

1. The male parentage is not regulated. Even the best selected ears have some mediocre sire or male breeding.

2. Too close breeding (resulting in loss of vigour) is brought about in the breeding plot, and thereafter by only four or five of the best "remnant ears" being used as the foundation stock of the improved strain.

3. Insufficient increases in yield (it is stated) have been recorded on comparing the improved strain with the original strain to which ordinary selection alone has been applied.

The new methods of maize-breeding which are now being developed in America, are based on the following points :—Self-fertilisation, if carried on for some time causes loss of vigour and diminution in size to a certain stage but no further. This stage is reached as soon as the selected individuals are either pure dominants or pure recessives, *i.e.*, homozygous for their many characters. All self-fertilised lines, therefore, become more uniform, but some lines do not lose vigour owing to consanguinity, as quickly or as much as others. In the recombination of such inbred strains increased vigour is at once restored, and a high yielding and uniform strain of maize is evolved which is said to be far superior to the original variety.

The advantages of this new system, which is referred to as "selection in self-fertilised lines," are apparently :—

1. Individuals with defective germ plasm suffer total extinction when self-fertilised for some time, though they may produce fair ears when bolstered up with cross-fertilisation. This is a valuable elimination of the unfit which it seems impossible to effect in any other way.

2. The greater uniformity of inbred strains and their combinations—when a line becomes homozygous for any character it always remains so.

3. Once the pure strains are obtained and the particular recombination which gives the best yield is established, the same result can be produced each time the cross is made.

The possible disadvantages of this system are :—

1. In any self-fertilisation, the amount of grain produced by a given maize plant is not visible until some time after fertilisation is effected. It may be possible to overcome this by establishing correlations between the field characters of the plant and the size or weight of the ear produced. This has not yet been done, and at present no likely correlation seems to exist.

2. Six to ten years self-fertilisation is required to bring a line to an homozygous and stable condition.

3 The methods involve considerable tedious work which an ordinary farmer would not have the time or the patience to undertake. Its use would therefore be restricted largely to experiment farms, where practically only one variety can be grown.

4. The skill of the operator or breeder plays a large part in the results obtained.

5. A large amount of material must be used; at least 100 ears are desirable to start self-fertilised lines. As the grain production cannot be judged until after fertilisation, it is necessary to self-pollinate four or five ears in each line, three of which should be grown, making at least 300 lines.

6. The selection of the poorest plants to be self-fertilised may mean the encouragement of defective or weak germ plasm, while the selection of the best plants tends to perpetuate plants in a heterozygous condition, which are usually the most vigorous.

7. The method of self-fertilisation in maize by the use of bags on the silks and tassels does not sufficiently safeguard the introduction of foreign pollen in the field during the act of uncovering the silks.

8. There is no definite correlation between the producing capacity of inbred strains and the progeny of the crosses produced from them. All possible combinations of the inbred strains have to be tried and tested. If twenty pure lines are produced, at least 380 combinations have to be kept isolated and tested for yield, as even reciprocal crosses do not always give the same result.

9. First generation hybrid seed from two inbred strains is at a serious disadvantage on account of its small size.

10. Double crossing (*i.e.*, the combination of two first generation crossbreds) to overcome the latter disadvantage adds another year or two to the time taken to make and test all the combinations, and means probably twelve to fifteen years at least to produce an improved strain of maize.

11. If the improved strain of maize is allowed to be grown for a few years, the vigour is lost, due to inbreeding or close breeding, and the yielding capacity becomes no better, perhaps worse, than that of the original variety. This possibility is likely with many farmers among whom the improved strain of maize would be distributed.

12. If the area devoted to the raising of pure lines is one or two acres, as seems at least necessary, substantial loss takes place for many years on a small farm, owing to the poor yields obtained from this area.

13. No definite figures have yet been shown comparing the strain obtained by the new system of breeding with the original variety, or with the variety improved by a good system of ear-row testing.

The objections previously raised to the ear-row test as a method of obtaining increased yields of maize may be expected to disappear under certain conditions. As long as substantial variations occur in the yielding

capacities of different ears within the variety of maize, it is contended by the writer that higher yielding strain of maize can be produced by this system.

The details of the ear-row method which is being continued in New South Wales (despite the introduction of these latest systems in America) have been altered slightly since its commencement, and the following description of the methods now being employed by the writer is given :—

Each year thirty-six ears, field-selected from the previous year's ear-row test, are submitted to the same test in rows about 3 chains long. These ears are the best that can be obtained (on appearance and weight), observing the precaution that no ear is selected except from a three-stalk hill and surrounded by a good stand. In this way each selected ear in the ear-row test has apparently some inheritance of yielding capacity behind it, at least on the dam or mother side. Occasionally an ear of exceptionally good appearance from another breeder of the same variety, or from a field area, is included in this plot which occupies about an acre in area. Until lately every fifth row was sown with bulk seed selected from the "breeding plot," but now this check row is sown alternately with an ear-row throughout the plot. Now the breeding plot, as before mentioned, is a small plot consisting of the best four or five remnant ears of the previous ear row test. Of these, the progeny of the two highest yielding ears are detasselled and allowed to be cross-fertilised by the progeny of the next two or three highest yielding ears. From the detasselled rows in this breeding plot sufficient seed is usually selected to sow the check rows for the ear-row test next season, and to sow a special multiplying plot of a few acres. This multiplying plot is the plot from which the seed is selected to sow the whole farm area the following year.

As the ear-row test, the breeding plot, and the multiplication plot are continued each year, it will be seen that new and improved seed is produced each year in the breeding plot, and that each year also a new "strain" of seed is produced for the farm area. This method overcomes the objection that the breeding is somewhat close, and loss of vigor is likely to result after a few years from consanguinity, for fresh seed is produced for the farm each year.

Now it is readily allowed that consanguinity is not a danger in itself, provided the individuals mated are of robust constitution.

There may be a tendency to close breeding in the ear-row test on account of selection for uniform type which is more likely to contain homozygous characters, but this is to some extent obviated by the occasional introduction of good ears of the same variety from outside sources, and by the insuring of robustness or ability to yield from the method of field-selection practised.

Again, any ears in the ear-row test after the second year have to be very good to be able to beat the check rows in yield, which are sown with the best seed from the breeding plot, which in turn, as stated before, is sown with the elite remnant ears of the previous year's ear-row test. But some individual ears still are able to do this, and they are then eagerly made the breeding plot of the following season.

That stud seed from the detasselled rows of the breeding plot is superior to ordinary selected seed of the same variety, is proved by the following results which have been obtained in New South Wales to date :—

Locality.	Variety.	Season.	Yield per acre.		
			Stud Seed	Ordinary Selected Seed.	Per cent. Increase in favour of Stud Seed.
			bushels.	bushels.	per cent.
Hawkesbury Agricultural College ...	Red Hogan	1916–17	78·26	67·33	16·1
Grafton	Leaming	1916–17	35·17	24·5	46·5
Yarramalong	Improved Yellow Dent..	1917–18	39·42	34·0	16·9
Kangaroo Valley . .	,, ,,	1917–18	76·34	67·33	13·3
Paterson	,, ,,	1917–18	104·28	87·0	20·1
Comboyne ...	Leaming	1918–19	60·9	51·31	16·7
Charity Creek ...	Improved Yellow Dent.	1918–19	78·4	72·0	8·4
Leeton	Funk's Yellow Dent ..	1918–19	20·44	17·32	18·3
	Average		61·40	52·38	19·5

That some ears in the ear-row test can still beat this stud seed in yield, and are then used as residues for the breeding plot the following year, shows that the maize-breeding work in New South Wales has been conducted on safe and sure lines up to the present. What the future will reveal is not apparent, but the ear-row test cannot be given up lightly in favour of something different until it is proved that it is not obtaining results.

It must be stated that, in the first place, the ear-row test has only been in operation on a variety of maize at the most for six years here; but the present status (with the results achieved), overcome objections to the ear-row test as a means of improving the yields of a variety of maize which are being raised of late years in America.

There is, perhaps, this difference, that the varieties of maize in America, having been subjected to selection and ear-row breeding, are much more uniform than our varieties in New South Wales. and that the great differences we get in our ear-row test between the yields of the different ears are not in evidence there.

This may be so, but the details of the method for ear-row testing, which have been described here, are not known to have been practised in America and, while the varieties of maize which have been subjected to this system still out-yield nearly all other varieties which are pitted against them, and are rapidly becoming the most popular varieties in New South Wales and in other States, it is felt that the continuance of the system of breeding outlined is justified.

IF the male bird in a yard of turkey hens has to be changed, it is not safe to regard the eggs as fertilised by the new bird until the hens have ceased to lay, and have started again.—JAMES HADLINGTON, Poultry Expert.

Electricity on the Farm.

O. C. BALLHAUSEN, Dairy Instructor.

For some years schemes for harnessing the upper waters of certain rivers for the development of electrical power have been keenly advocated by competent authorities. Hydro-electric schemes on tributaries of the Clarence for the supply of electricity for industrial purposes for the whole of the north-eastern corner of the State have been given much prominence. The success of these schemes is predicted by expert engineers who have investigated them, and the only difficulty appears to be to find the money necessary for their development.

While these big schemes are under notice, it is interesting to see what can be done by progressive and ingenious farmers in a small way to provide cheaply all the power required on the average dairy farm. There are very many farms in the coastal areas, with permanent flowing streams, which could have all the advantages to be derived from a small hydro-electric supply. The benefits of electricity can easily be extended to the household for the provision of city comforts and conveniences, such as lighting, ironing, heating, and also cooling by means of fans, making farm life much more attractive, especially for the women-folk. There can be no question that the more attention is devoted to comfort and the making of farm life more attractive, so will the drift of the younger people to the towns and cities be appreciably lessened, with advantage to the State.

In 1914, Mr. J. C. Fredericksen, a dairy-farmer of Rous Mill, near Lismore, after seeing a fine little stream of water on his property practically running to waste for a number of years, determined to use this water to supply electric current to operate his farm machinery, and to light his house and outbuildings. Since that time, and from the same plant, the service has been extended to the house of his two sons living close by, and a still further extension is to be made to the houses of two more sons. The plant is probably somewhat larger than the average homestead is likely to require, but a plentiful supply of power at any time is a great advantage.

Since the erection of the plant in 1914, there has not been a mechanical hitch of any kind, and seeing that neither Mr. Fredericksen nor his sons had any previous experience with electricity, its simplicity s apparent. It is as reliable as any other form of power on the farm. On two occasions when abnormally dry weather affected the flow of water in the creek, Mr. Fredericksen utilised his motor car for working the milking machines, raising the car from the ground and attaching a driving pulley wheel in the place of one of the back wheels. This was necessary for only a few weeks, and of course the lighting of the house was affected, but for such a brief time as hardly to be worth consideration.

A brief description of the electric plant and its uses might be of value to others contemplating a similar service.

A small wall of stone and cement was constructed across the creek on a stony bottom to impound or dam the water and give the necessary weight. This is situated just above a small waterfall. From the bottom of the dam

A Hydro-electric Plant on the Richmond.

The pipe-line, pelton wheel, and dynamo as seen when erected in 1914. A shed was in course of erection when the photograph was taken.

the water is carried through 210 feet of 10-inch wooden pipe to a pelton water-wheel. The vertical fall from the dam to the water-wheel is 76 feet, and by means of a large water valve the force of the water on the wheel is regulated.

The diameter of the pelton wheel is 3 feet 6 inches, and by using a 3-inch delivery nozzle 17 horse-power is obtained from the wheel, while a 2-inch nozzle will develop 12 horse-power at 300 revolutions per minute. By the use of still larger water cups on the wheel it is estimated that up to 25 horse-power could be obtained.

The 12 horse-power delivery is used for driving, by belt connection, a 6½ horse-power generator at 1,500 revolutions per minute, thus supplying 240 volts, or more than sufficient for all the lighting, &c., of three houses and all the power required on the farm.

A 5 horse-power electric motor near the dairy operates the milking machines, a 6-cow-plant, milking over 130 cows, as well as separator, lathe, grindstone, and a saw bench for firewood and for board sections for banana boxes. At one of the sons' homes a 3 horse-power motor is used for corn-shelling and for the shelling of bush nuts, of which from 2 to 2½ tons are secured annually from an acre of trees. The bails and dairy, in addition to the houses, are all electrically lighted, and in the houses the current is also used for fans, radiators, hot water urns and ironing.

The system is a direct current one, and no storage battery is used, so a method had to be devised for obtaining the current quickly, and without a long walk to and from the creek to turn on the water. By means of a double wire, supported by small pulleys on opposite sides of the electric cable posts, and by a wooden roller in the dairy, the operation of the generator is controlled at the creek a little over a quarter of a mile away. The wires are connected with the water valve, and by winding the roller in one direction one wire is wound on to it which causes the valve to open and permits the water to turn the wheel. By turning the roller in the reverse direction the other wire is wound on to the roller, closing the water valve and thus stopping the machine. A similar contrivance erected near the house verandah, and connected by branch wires to the main wires, is used in the same way, and avoids the necessity of a walk to the dairy to start or to stop the wheel when bed-time arrives.

Mr. Fredericksen has included banana growing in his farming operations during the past two years, and the plants are now bearing well. All the banana cases are made from trees growing on the farm. A small sawmill, with 2 and 4 foot circular saws, has been placed to drive direct from the pelton wheel—17 horse-power being used for this work. By means of a small short tramline, the logs are run down the creek bank to the little sawmill, and after being cut into boards are again hauled up, the power required for hauling the little truck being obtained from the water wheel.

The cost of the whole plant, inclusive of the milking machines, but exclusive of the sawmill (which was mostly made on the farm), was approximately £600, but the plant is larger than most farmers would require. The total cost per annum for providing all the power and lighting, which includes belt renewals, lubricating oils and all costs, is well under £5. The total cost for oil alone for the seven years has been under 30s. Interest

and depreciation are not included, but the life of the pelton wheel, generator and motors can be regarded as indefinite, as, after seven years' use, they are as good as when they were first set in motion.

For water supply to the house, water troughs and dairy purposes a water ram is used, delivering, 1,200 gallons each twenty-four hours from the creek. The delivery to the house is equivalent to a vertical lift of 280 feet. No other method of pumping water is so cheap as this, and it meets all the requirements of the place. It is surprising that so very few dairy farmers make use of this simple and reliable contrivance for providing a plentiful supply of water for general farm use.

So many advantages are to be derived from an electrical and pumping equipment of this kind—the comforts and independence, the simplicity and long life of the machinery, the low cost of upkeep, &c.—as compared with ordinary forms of farm power, that any farmer having the facilities in the way of water supply, is simply not alive to his own interests if he neglects to make use of them, according to his ability.

NEW FARMERS' BULLETINS.

THE following additions have recently been made to the list of bulletins published by the Department of Agriculture:—

No. 58, Hides, Skins, and Sundries (Second Edition). Price, 10d. post free.
No. 136, Neutralisation of Over-ripe Milk for Cheesemaking. Price, 10d. post free.
No. 137, Safeguarding Farm Stock from Disease. Price, 10d. post free.
No. 139, The Culture of Sugar Cane in New South Wales. Price, 10d. post free.
No 140, The Pruning of the Vine. Price, 10d. post free.

These bulletins are obtainable from the Government Printer, Phillip-street, Sydney.

AN INJURED TEAT AND THE TREATMENT.

"A DAIRY cow (an extremely heavy milker) has had one of her quarters badly cut on barbed wire. It has all healed again, but half-way up the teat it has left a small hole, from which milk is continually dripping. The cow is being dried off in the hope of the injury being cured when there is no flow of milk to interfere with it."

The writer of the foregoing was thus advised:—I would not advocate treatment until the cow is dried off, and even then it may not be very easy to close this fistula; but in order to assist it I would recommend you, when she is dry, to take a perfectly clean knife and scrape the edges of the hole until the blood just shows; then with a fine needle and thread put a stitch in the outside skin of the teat and draw the sides of the hole together. Leave the stitch in for a few days, washing the teat each day with boiled water with a very little disinfectant in it, and then remove the stitch when it appears that the opening is closed. Make sure that everything used is very clean.—S. T. D. SYMONS, Chief Inspector of Stock.

Co-operation for Farmers.

[Concluded from page 559.]

C. C. CRANE, B.A., Organising Inspector of the Agricultural Bureau.

IN order that a co-operative undertaking may at all times be conducted on the strictest business principles, and that all the steps in its formation may be conducted methodically and formally, the following plan of procedure is suggested as a model on which communities may act. Formality is necessary in order to promote confidence, and to guarantee that the venture proceed along lines clearly understood, so that suspicions of ulterior motives on the part of organisers and active workers may not arise.

The Beginnings of a Co-operative Society.*

The initial work is to interest a few men of the right type as a nucleus, and to instil in them the ideals and objects of the proposed co-operation, at the same time reducing the proposal to a practical form, and defining as approximately as possible :—

1. What the proposed co-operative society is calculated to effect.
2. The amount of capital that will be required.
3. The number of shares that will have to be issued.
4. The amount of capital that can be actually subscribed, and the amount that may have to be raised by loan.
5. The method to be adopted to secure the loan.

These few interested men should then allot among themselves the district proposed to be canvassed. They should be able to guarantee that every resident likely to be interested has had the matter carefully explained and has been invited to become a shareholder, to indicate how much share capital he would be prepared to contribute, and further to attend a public meeting to inaugurate the society. They should appoint one of their number to be the provisional secretary, and empower him to make arrangements for holding a public meeting.

Public Meeting.—This should be held as soon as convenient after the canvas of the district. It would be well at such a meeting to secure the services of one or two practical co-operative experts, whose hints and instructions would possibly help the venture to steer clear of pitfalls.

The business of the first public meeting should be :—

1. To adopt a motion that a co-operative society be formed.
2. To collect names of intending shareholders and deposits on capital.
3. To appoint provisional officers (president, secretary, and treasurer, and a committee of from three to seven.

* In the compilation of this portion of the article I have had valuable assistance from Mr. Grierson, Manager of the New South Wales Co-operative Wholesale Society.

Of these officers, the secretary is the one on whom the brunt of the work will fall, and in making a selection it is essential:—

1. That he be a progressive man.
2. That he have a good practical knowledge of book-keeping, accounting, and financing.
3. That he have a good grip of practical co-operation.

The secretary will be the official representative of the members, the mouthpiece of the shareholders. He will not be a permanent official, but should be elected annually. He should be approachable and tactful, and capable of inspiring confidence.

The First Committee Meeting.—In preparation for this the provisional secretary should obtain for the members of the committee:—

1. A copy of the New South Wales Building and Co-operative Societies Act of 1901. (Obtainable from the Government Printer, Sydney.)
2. Copies of rules, books, and by-laws of co-operative societies running on parallel lines. The New South Wales Co-operative Union has prepared a model set of rules which would be applicable to any such society.
3. Any other information that would facilitate the business of the first committee meeting being carried out intelligently.

The business of this first committee meeting should be:—

1. To define the objects of the society.
2. To draw up a code of rules, standing orders, &c.
3. To arrange for the registration of the society. This can be done free of charge through the Registrar of Friendly Societies, 36 Young-street, Sydney.
4. To decide on a site for commencing operations.

The First Regular Meeting of the Co-operative Society.—The proposals of the committee should at the earliest opportunity be referred to the members of the society at a meeting of all members. The business of that meeting should be:—

1. To confirm the appointment of officers and committee.
2. To debate the proposed objects, rules, standing orders, &c., and to adopt a set for the direction of the society.
3. To decide on a policy.
4. To enrol shareholders.
5. To receive further deposits on capital.

The Second Committee Meeting.—At this meeting it would be proper—

1. To consider the commencement of operations.
2. To consider the appointment of a manager.
3. To call applications for a manager.

The Manager.—This officer of the society should approximate the following ideal :—(1) He should have a sound business knowledge of co-operation. A man with a business training would quickly acquire co-operative knowledge. (2) He should have business honesty and integrity (these are preferable to brilliancy). (3) He should be progressive, but zeal and earnestness if misdirected and unaccompanied by business knowledge make more for disaster than success. (4) He should have a good practical knowledge of book-keeping and accountancy. (5) He must be tactful, for he will have to administer the whole business.

It is better to let the manager grow with the business than to try and build a business up to the manager. At the same time, a cheap manager is not to be recommended, for good brains are required for management, and they must be paid for.

It must be remembered that: (1) The committee must be largely guided by the manager in the matter of stocks and plants. (2) The manager should co-operate with the committee in all things. He should be admitted to all committee meetings, enter freely into discussion, but exercise no voting power. (3) The committee must lay down the policy on broad lines, and give the manager clearly to understand that they require him to act upon the lines indicated by them, the ultimate control of the society being retained in the hands of the committee. (4) The appointment, control, and discharge of assistants should be left to the manager, but assistants should have the right of appealing to the Board against the manager's action within one week of the event. Wherever possible, the manager's position should be upheld, but provision should be made in the rules that in the event of serious error on the part of the manager, he should be dispensed with and the assistant retained.

The Third Committee Meeting should proceed :—

1. To appoint a manager.
2. To appoint an auditor. A fully qualified man should be engaged and paid for his services, as many co-operative societies go to the "Co-operative Cemetery," through lack of professional auditing.
3. To enrol members.
4. To collect further deposits on capital. (This work may now be continuous.)

After these initial meetings the committee should meet regularly according to rules. An annual general meeting must be held at which the election of office-bearers should take place.

General Considerations.

It is best to commence trading with the usual co-operative lines, subject to the necessary modifications to suit local conditions, and to extend gradually as capital becomes available.

It is wise to commence and continue the society on a strictly cash basis, that being a sounder, simpler, and more economic class of business. In cases where it would be inconvenient, there should be provision that members who wish to obtain credit must have a separate trading account (approximately an advance account), which really means that the customer pays in advance. Some societies allow each member credit not exceeding three-quarters of his paid-up share capital, but, of course, if money has to be raised by loan on the security of capital not paid up, this method becomes involved.

Generally speaking, credit custom is to be avoided , for it is poor economy and it becomes a dangerous policy in the hands of a weak or careless manager.

As much share capital as possible should be obtained, the minimum holding being sufficiently small not to exclude possible members, for in a co-operative store any discrimination of class, creed, or colour must be sternly repressed. In a cash concern £5 should be the minimum, and in a credit concern £10 to £15, unless, of course, the alternative plan of separate trading capital be selected. £250 in shares is the maximum amount that a member can hold under the act.

If all the capital necessary for preliminary operations can be obtained by subscription so much the better. If not, it may be obtained as a loan on the security of uncalled capital or on the individual guarantee of one or more of the members.

As under the act each member's liability is limited to the unpaid balance of the shares allotted to him, and as he has the right to withdraw his share capital, the unpaid capital does not always present the best security, although the act does provide that a member's liability remains till twelve months after his withdrawal from the society.

A rule fixing the maximum amount of interest payable on capital should be made. The actual amount to be paid will be left to the discretion of the committee, and is usually the prevailing market rate.

The store should not attempt to cut prices, except in such cases as may demand it. Sell the best quality, full weight, at current prices. After paying overhead charges, &c., refund the surplus to members *pro rata* on their purchases. The store should be considered a social movement. It is to be run for use, not for profit. If it represents financial gain so much the better. The store should be looked upon as the A.B.C. or kindergarten of the movement.

All societies should affiliate with the Co-operative Union, the organisation which undertakes the legal, educational, and propaganda work of the movement. To affiliate, each society takes up one £1 share and then pays ½d. per annum per shareholder. This is in direct accord with the principles of the Rochdale movement, for even the pioneers allotted a certain regular amount for education and propaganda.

Affiliation with a Co-operative Wholesale Society.

All societies should affiliate early with a co-operative wholesale society. Such a society will afford protection against combinations of proprietary interests, enable the inexperienced buyer to buy on the same footing as the more experienced one, and give the store the same privileges as the co-operative store gives to the individual member.

Generally speaking, each society in such a co-operation should take up, say, one £2 share for every member, increasing the number of shares as its own members increase. The capital could be called up as required, say 1s. per call, and not more frequently than say once a quarter. A refund of any profit must be made to the affiliated societies, of course, though such profit might usefully be applied to the increase of the capital.

Flood Deposit that Corroded Wire Netting.

A SAMPLE of soil from the Western Land Division, described as being brought down by the Bulloo flood waters and having a disastrous effect on any wire-netting about which it lodges, was recently forwarded to this branch for analysis. It was remarked that the effect of the soil was to remove all the galvanising from the wire, and the question was whether the wire could be treated in any way to counteract the action of the soil.

The soil gave a strongly alkaline reaction to litmus paper, and a water extract gave the following results:—

1.049 per cent. chlorine, equivalent to ·081 per cent. sodium chloride.	
Sulphates ...	Faint trace.
Lime ...	Nil.
Magnesia ...	Nil.
Alkalinity (as sodium carbonate) ...	·097 per cent.
Total water soluble salts ...	·27 ,,

The corrosive action of the deposit was certainly due to the high alkali content, and dipping the netting in or painting it with a mixture of equal parts of coal tar and Newnes pitch (made by heating both together) would be the cheapest and most effective method of protecting it, but whether it would be either practicable or economical would have to be considered. City firms quote coal tar at 4½d. per gallon (84s. for 224 gallons), and Newnes pitch at £14 per ton.—F. B. GUTHRIE.

To Make Liquid Manure.

SOAK a sugar bag of fresh cow, pig, or poultry manure for a week in 50 gallons of water. Use this at the rate of one part for three parts of fresh water. The same bag of manure will make another 50 gallons by using one part of the liquid to one part of fresh water. A third quantity of 50 gallons may then be prepared and used neat. Each 50 gallons should be a week old before using.

This form of liquid manure is all that is necessary for most growing crops used weekly. Apply 4 gallons to every 18 feet of a running row. No further stimulants need be added.—E. N. WARD, Superintendent, Botanic Gardens.

Is the Seed Buyer entitled to Protection?

Every seedsman's catalogue contains what is known as a "non-warranty clause," which states that while every care is taken to supply high quality seeds, the vendors accept no responsibility as to the growth, description, quality, or productiveness. The only protection the buyer has is the desire of reputable firms to preserve their good names. The question whether such protection is sufficient is being freely discussed in many quarters just now. The following experiences with seed purchased from seedsmen suggest that the buyer is not sufficiently protected:—

Egyptian Turnip-rooted beet seed produced many plants more resembling mangels than beets. From so-called Succession cabbage seed a miscellaneous collection of cabbages of various types were raised, about one-half of which belonged to the Succession variety. Two different lots of Savoy cabbage seed gave plants many of which showed evidence of being crossed with smooth-leaved cabbages. Less than one-quarter of the plants raised from a packet of Early Short Horn carrot were true to the variety, the remainder being of the Intermediate type.

Seeds may lack in germinating capacity as well as in trueness to name. This has been noticed in onions. Green Feast peas sown in the same ground and at the same time as Yorkshire Hero failed to grow while the latter have done well. The most striking case of bad germination recently was with two packages of Earliana tomato seed. Samples were obtained from two different seedsmen and tested; one gave 20 per cent. and the other 70 per cent. germination in eight days. The poorer seed was sown at the same time as some seed of last year's purchase which had been very successful. The poorer seed has given less than half the germination of the other, and the seedlings are weak and have only made about half the growth of the sturdy young plants from the better seed.

No striking cases of bad seed have recently been noted in farm seeds, but several cases during the past year are worth noting. A sample of white sweet clover produced more lucerne than clover. Another of rye gave an effective germination of 65 per cent., as against which 85 per cent. is a fair standard. In still another case, Black Hull-less barley was sold to a farmer as skinless barley, and as such sown by him.—W. M. Carne, Lecturer in Botany, Hawkesbury Agricultural College.

Beans and Cauliflowers at Orange.

"What are the prospects of cauliflowers and beans in a district like ours?" wrote an Orange reader. He was informed as follows:—

Both cauliflowers and beans can be grown in the Orange district, but frosts will, of course, make the cultivation of beans only possible during the warmer months of the year. If intended for Sydney markets it will be well to note that during the winter the market is more or less glutted with local beans if the season is at all favourable.

The climate is quite suitable for cauliflowers, but success will depend upon the quality of the soil. In the Bathurst district, where the vegetable is so largely grown, the alluvial flats are selected for the growing of the crop. There is usually a good market for this vegetable, which is available during the winter months. Attention must be given to protecting the heads from frost.—A. J. Pinn, Inspector of Agriculture.

The Shot-hole Borer.

(*Platypus omnivorus* Lea.)

W. W. FROGGATT, F.L.S., Government Entomologist.

THERE are a number of small beetles which damage timber and which are popularly known as " borers." They attack it in various ways. Thus, the powder-post beetle (*Lyctus brunneus*), previously dealt with in this journal (page 273, 1920), reduces the sapwood of many Australian timbers to dust, while a second group of beetles, represented in Australia by *Anobium domesticum*, also remain in the infested timber for years, burrowing through and through it in successive generations until there remains nothing but a shell covering a honeycombed mass, somewhat like wood that has been ravaged by white ants. I have had timber under observation in a building for over ten years, and the *Anobium* beetles and their larvæ can still be found at work in the originally intested boards. Mr. C. French, junior, in a paper, " Furniture and Timber Boring Insects " (*Journal of Agriculture of Victoria*, 1918), calls *Anobium domesticum* the " pin-hole borer," but I would limit the popular name pin-hole borer to the beetles that cut direct burrows through the timber they attack and that do not reinfest it over and over again, as does *Anobium domesticum*.

Under the ordinary conditions of forest life, when a tree is damaged it sickens and dies in the scrub, or it is cut down by the timber-getter. The decay or fermentation of the sap of the bark attracts all the wood-boring beetles in the vicinity. Some come simply for food and eat the surface, others to both feed and lay their eggs upon it, while many beetles themselves bore directly into the trunk.

There are a number of small wood borers that can aptly be called shot-hole borers; they bore circular burrows straight into the timber through the bark, and of these *Platypus omnivorus* is a typical example. The infestation of the timber by the true shot-hole borers may take place in the forest or brush before the fallen tree is hauled to the sawmill, or while the logs are lying in the sawmill yards previous to being cut up, or even after they have been sawn up and while the boards are seasoning in the stacks under the sheds.

The genus *Platypus* was formed by Herbest in 1793, for some European wood borers, and all the species of the genus were described and figured by the French entomologist Chapius in his " Monograph of the Family *Platypedæ* " in 1865. These beetles are widely distributed over the forest areas of the world, but they are most numerous in the forests of North and South America and in the Malay Archipelago. One species has been recorded from New Zealand, and three from Australia. The species now discussed

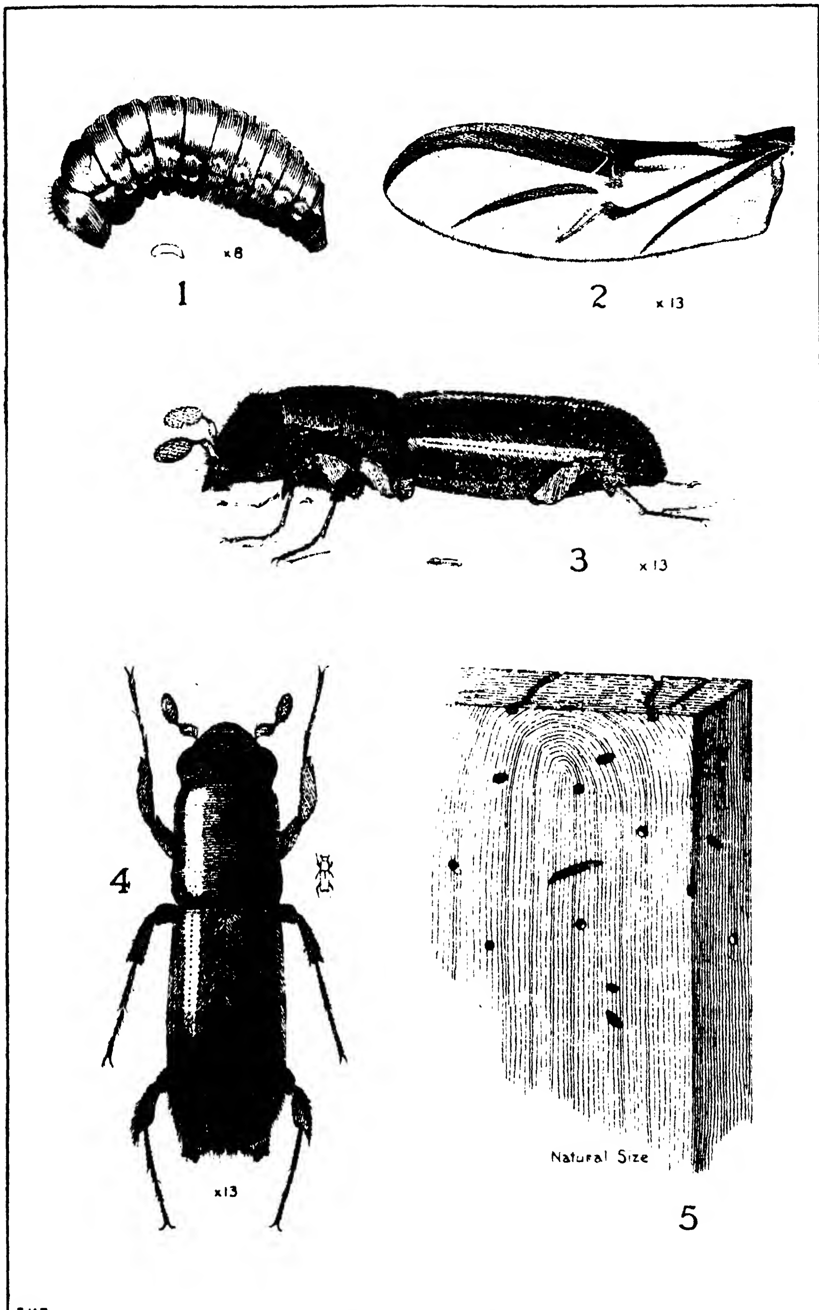
was described by Lea from Tasmania, and I understand from him that this is the first record of it from the mainland. French has described and figured a Malayan species (*Platypus corpulentus*) obtained from timber in a Melbourne timber yard (" Handbook of Destructive Insects of Victoria," pt. v., p. 81, pl. 80); but so far as I know it has not become established in Australia.

Our common shot-hole borer (*Platypus omnivorus*) is widely distributed through the New South Wales coastal forests, commonly known as " brushes" or " cedar brushes." My observations on its habits and life history were carried out last summer at a sawmill where large quantities of brush timber trees are cut up in boards and lengths for the manufacture of furniture in Sydney factories. The principal timbers damaged by these beetles are beech (*Trochocarpa laurina*), blackwood (*Acacia melanoxylon*), corkwood (*Schizomeria ovata*), sassafras (*Doryphora sassafras*), and coachwood (*Ceratopetalum apetalum*).

These beetles are not noticeable during the winter months, but are very active in December, January, and February. They not only penetrate the sapwood, but bore into the solid material of the logs for some distance. They also attack the newly-sawn boards while they are drying, but when after exposure for a month or so, the sap has dried out, the timber loses all its attractive properties and the borers leave them alone. When I visited the sawmill in the middle of February there was a stack of damaged boards drying in the shed; these were just in the condition attractive to shot-hole borers and there were numbers of beetles in burrows formed in the wood. On some of the boards the beetles were busy laying their semi-transparent rounded eggs in the ends of burrows in contact with neighbouring boards, and on other boards we found the active larvæ, while the outside of the stack was showing signs of attack by beetles that had made their way in from the surrounding forest. We soon made a large collection of the beetles by taking each board and pushing a dry grass stem into some of the burrows, thus forcing the inmates out into the killing tube.

The beetle is a typical cylindrical borer, of a general dark reddish-brown tint. The front of the head and prothorax are almost black, the legs reddish-brown, the apex of the wing covers clothed with stiff yellow hairs, curiously serrate at the tips, as shown in the figure. The beetle measures a little over 4 m.m. in length. The whole structure of the beetle—its cylindrical form, the head flattened in front, the curious shape of the shovel-like tibia of the fore legs, and the brush of coarse hairs on the extremity of the wing covers—is adapted to its mode of living, by boring through the timber and brushing out the waste dust as it excavates its burrow.

Forest entomologists in Europe and North America have studied the habits of a number of species found in these parts of the world, where an immense amount of damage is often caused to timber in the pine forests. The general experience of these investigators is that preventive measures are the only ones that have met with any success; such measures consist of the removal of all dead and dying trees from the forest areas, and their



The Shot-hole Borer (*Platypus omnivorus* Lea).

1. Larva. 2. Hind wing. 3. Side view of the perfect beetle. 4. Dorsal view.
5. Timber, showing the damage caused by the borer.

destruction before the beetles develop and emerge from the infested wood. I. M. Swaine has written some important monographs on Canadian bark-beetles (Dept. Agriculture, Ottawa, 1917–18), and in these he points out that forest fires provide much material for beetle infestation. W. J. Chamberlin, of the Forest Branch of the Oregon Agricultural College, has carried out and published records of some very interesting observations on the pine bark-beetle (*Dendroctinus brevicornis*) in the great pine forests of that State. M. W. Blackman, of the New York State College of Forestry, has studied the habits of *Pityogenes hopkensi* and other allied species that attack the larch; and Dr. A. D. Hopkins, of the U.S. Department of Agriculture, has published many papers and monographs dealing with the shot-hole borers of the United States.

When timber has been cut and is stacked, it is still liable to infestation until it is quite dry. The beetles can, however, be kept away by the use of carbolised sawdust sprinkled beneath the stack and between the layers of boards and battens as they are stacked. A 5 per cent. solution of water and carbolic acid is mixed into a bucket of sawdust, and the moist sawdust is freely sprinkled over the timber. A sawmiller to whom I recommended this treatment of sawn seasoning timber informs me that he has had no timber damaged after it has been treated in this manner.

A Question about Carrots.

To a correspondent who asked about the production of carrots, the following was supplied:—

Practically any soil can be fitted for the cultivation of carrots, but a sandy loam is preferable. It is necessary that the soil be worked to a fine tilth; otherwise difficulty may be experienced in obtaining a good germination. Care must also be exercised in manuring, and stable manure should not be applied just prior to planting, as this will produce forked roots; land that has been manured with stable manure for previous crops, however, may be used with little fear on this account. Of the artificial fertilisers a mixture of superphosphate and bonedust in equal quantities, at the rate of 3 cwt. per acre, can be applied with advantage, and this may be supplemented by adding any available wood ashes to the plot in order to supply potash.

The seed can be sown either by hand or by means of a hand seed-drill, planting to a depth of half an inch. A plentiful supply of water is necessary for the best quality roots, and after sowing it is often an advantage to firm the soil slightly in order to help germination. If germination is good it will be necessary to thin the plants lightly to prevent wedging, and a further thinning can be made when the roots are sufficiently large to be used as a soup vegetable, leaving the final spacing between the plants about 3 or 4 inches.

Sowing in spring is usually the most satisfactory, but sowings can be made well into the summer. Four pounds of seed are required to sow an acre. For an early crop on shallow soils the best varieties are Early Horn or Early Nantes, but for deeper soils the longer varieties may be used and Intermediate may be recommended.—A. J. Pinn, Inspector of Agriculture.

Experiments for the Control of Armillaria Mellea.

W. A. BIRMINGHAM, Assistant Biologist, and W. B. STOKES, Fruit Inspector.

RECOGNISING the loss and damage caused by the honey fungus (*Armillaria mellea*) in citrus orchards, the Department, three years ago, thought it desirable to institute a series of experiments to see if some cheap and easy method of control could be found.

The co-operation of a grower in the St. Ives district was sought, and he readily agreed to place the desired number of trees at our disposal. The experiment was commenced on 1st May, 1918; but the tedious nature of the work exceeded our expectations, and the work of preparing the trees for the different treatments was considerably prolonged. The experiment was confined to orange trees, and the preparation consisted of loosening the soil with a fork and clearing it away from the butts and main roots of the trees with small forks, trowels, &c. Infected roots were either sawn off close to the butt or cut through with a chisel or sharp tomahawk, and then traced out for some considerable distance, lifted, and placed in a heap ready for burning. On a superficial observation it frequently appeared that all the diseased tissue had been removed, but a closer examination often revealed that portions of the fungus had been left. It was repeatedly found, on clearing the soil away from the underside of the butt that the fungus had obtained a good hold there. Most of the trees were in a very advanced stage of infection, some having to be propped up after having the diseased roots cut away.

The following specifics were tested :—

1. Bordeaux paste (1½ lb. bluestone, 1 lb. quicklime, 2 gallons water).
2. Bordeaux paste—plus an excess of lime to make into a thick paste.
3. Lime-sulphur (Neptune) 1 to 5.
4. Sulphate of iron, 10 lb. to 10 gallons of water, 10 gallons per tree.
5. Slaked lime, 30 lb. per tree.
6. Sercsol, 10 per cent. solution painted on butt and main roots; 5 per cent. solution watered over the soil.
7. Qua-sul, 1 per cent. solution painted on butt and roots and watered over the soil.

Three trees were treated in each case with the exception of Qua-sul, where only two were used owing to shortage of solution. Three trees were kept as controls, the diseased parts being removed and the trees left untreated.

Tar brushes were used for applying the different specifics, and small paint brushes were convenient for getting into crevices. The butts and main roots were left exposed to the air for three days before replacing the soil. The trees were examined and re-treated in 1919 and 1920, and finally examined on 10th May, 1921, when the experiment was terminated, as the results obtained did not warrant its continuance.

The Results of the Experiment.

Only two trees showed no spread of the fungus from the commencement of the experiment—one tree having been treated with lime and the other with lime-sulphur. These trees were only slightly infected at the commencement of the experiment, and in all probability every trace of the disease had been removed. One tree treated with Sercsol showed no further spread in 1921, but had shown it in both previous years. The control trees all showed spread of the fungus.

Taking into consideration the fact that only two trees out of the twenty treated showed no spread of the fungus, and considering the work involved in the preparation and treatment of the trees, the Department is unable to recommend any treatment based on the results of this experiment. Another series of experiments has already been put in hand, but some considerable time must elapse before any conclusions can be drawn.

Control Measures Recommended.

It is hardly possible to adopt effective control measures, but it is desirable that every means possible be taken to get rid of all stumps and roots before an orchard is set out. In districts where the pest is known to exist it might be advisable to sow newly-cleared land to some grain or other field crop (with the exception of potatoes, as they are susceptible to attacks of the fungus), for several years previous to its use for orchard purposes. In such cases care should be taken to see that the humus-content of the soil is not depleted.

When a tree is found in the early stage of attack the soil should be removed from the butt and main roots, the diseased bark at the butt removed with a sharp knife, and all diseased roots traced out as far as possible and removed and burnt.

It is recommended that when replacing the soil a fair proportion of the root-system be left uncovered (say 18 inches from the butt all round) for an indefinite period. Where possible, affected trees should be isolated by digging a trench 2 feet deep around them, such trench to be outside the spread of the root-system. All soil removed in the operation should be thrown on the inside of the quarantined area.

Trees found in an advanced stage of the disease should be immediately removed, as they are beyond treatment and are a source of infection to adjacent trees. When a tree is attacked in a new plantation it should be sacrificed at once. When trees are removed they should be burnt on the spot, the soil turned over, and a generous dressing of quicklime applied. The area should remain unplanted to fruit trees for a considerable time (several years, if possible), and in the meantime the soil should be repeatedly turned over and exposed to the sun. Lack of drainage favours the disease. When a tree is slightly affected there is every reasonable hope of its recovery with special and constant attention.

[The subject is well illustrated in Plant Diseases Leaflet, No. 18, of which copies are obtainable free on application to the Under Secretary and Director, Department of Agriculture, Sydney.]

Cheesemaking on the Farm.

J. G. McMILLAN, M.B.D.F.A., N.D.D., Dairy Instructor.

INTRODUCTION.

So frequently are applications addressed to the Department for information concerning cheesemaking on the farm and in the household that it has for some time been felt that articles presenting such information in compact and non-technical form would supply a very positive want. An effort has been made in the following pages, therefore, to deal with the subject in popular style, and as concisely as is consistent with the demands of the aspects discussed. The Australian is not, as a rule, a connoisseur of cheese, and although the fact may be attributed to various causes, the prime reason, one suspects, is that the article on the market is often inferior in flavour and therefore unpalatable. Our consumption of cheese per head is lower than that of any other white people. Yet 1 lb. of well-ripened cheese is equal in food value to 3½ lb. of lean meat, and the briefest study of comparative costs will show that the cheese is by far the cheaper food. Many people complain that cheese is indigestible; but while the charge may be admitted against an unripened article, it must be said that well-matured cheese is so easily digested that it is specifically recommended by some physicians for dietetic troubles. Moreover, cheese is not so heating to the blood as meat, and is therefore to be commended, if for this virtue alone, in such a climate as ours. For persons engaged in heavy manual work, such as miners, quarrymen, &c., it is an especially valuable food product.

Cheese (of which there are over one hundred different kinds) may be classified under three main headings—namely, (1) pressed varieties, (2) blue-veined varieties, and (3) soft varieties. It is proposed here to deal with numerous kinds of cheese, the manufacture of some calling for a certain amount of skill, and of others very little. The variety demanding most ability is cheddar, and this will be dealt with in a comprehensive manner, as many of the pressed cheese processes are simply modifications of the cheddar method. The same care of the milk is required whatever the variety of cheese, however. At present the bulk of our cheese is manufactured in large factories, but a fair quantity is nevertheless made on farms, and, provided the same skill is employed in its manufacture, it may be said that a better cheese may be made on the farm than at the factory, owing to the cheesemaker having the milk under direct control from the time of drawing. Taking one year with another, it is safe to say that a farmer who manufactures the product of from sixty or seventy cows into cheese will have a better income than if he had separated the milk and sent the cream to the factory. Where only a few cows

are kept other varieties of cheese than cheddar can be manufactured, while even the householder with only one cow may be a manufacturer on a small scale by converting his surplus milk into cheese for his own use.

To the dairyman who contemplates making cheese in fairly large quantities it will be obvious that his maker should preferably possess some skill to commence with, rather than that he should gain it at the expense of his employer and the product It is wise to aim at producing a good cheese from the very beginning—not to let an improving but mediocre article militate against its manufacturer's reputation even for a little while. If the intending cheesemaker has a son or daughter of, say, 17 or 18 years of age, he would be well advised to send him or her for a few months to some good factory, applying to the Department subsequently for a few days'

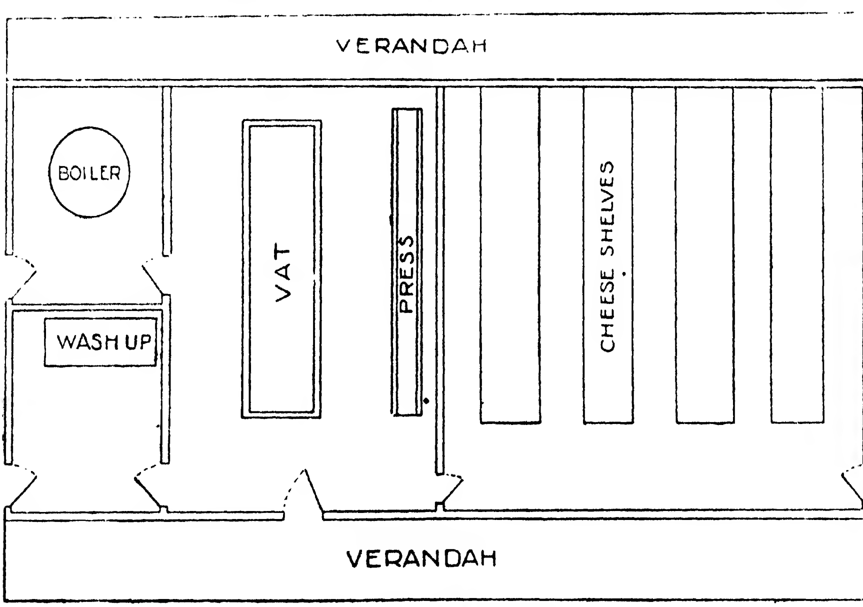


Fig. 1.—Plan of a small dairy.

tuition actually on the farm. The wisdom of such a plan was evidenced in the case of a northern rivers dairy-farmer recently. This gentleman's daughter went to a factory for a few months, and the writer assisted her not long ago for a day or two when she commenced work in her father's dairy. She is now turning out one of the best makes of cheese in the State; and even during the period when butter was selling at a more favourable price than cheese, her returns from cheese were considerably bigger than if she had sent the cream to the factory.

The Arrangement of the Cheesemaking Dairy.

The cheesemaking dairy should consist of three apartments—the manufacturing room, the curing room, and the boiler room. The manufacturing room should measure about 16 feet by 16 feet, and the curing room should

be of similar size, both with walls 10 to 12 feet in height. The boiler room may be separate from the main building; it should be built of corrugated iron or situated under a verandah. Figure 1 shows a dairy with the making and curing rooms alongside one another on the ground level; but in Fig. 2 is shown a dairy with the curing room underneath, an arrangement sometimes to be preferred, as indicated presently.

Situation.—The dairy should be situated in an elevated position, either on the top or near the top of a hill, thus allowing of good drainage for sewerage and the easy transit of whey by gravitation to the piggery or wherever it is utilised. Another advantage of such a situation is that should the water supply be obtained from a well there is less danger of contamination by soakage. The building should be at least 200 yards from a piggery where not more than twenty-five pigs are kept; where the number is greater than this the distance must be 300 yards. These distances are in compliance with the regulations of the Dairy Industry Act of 1915. Calf-feeding pens or poultry yards should be a considerable distance away, and even the cow yard should not be too close, the object of these precautions being to avoid, as far as possible, danger of infection through dust particles.

Construction of Making Room.—Most farm dairies are built of wood (mainly because of cheapness), and wood is satisfactory provided that the internal walls are lined with some impervious material, such as fibro-cement or galvanised iron, to a height of 6 feet. Conformation with this demand also is required by the Dairy Act. The rest of the walls and the roof should also be lined, and on top of the ceiling there should be placed several inches of (preferably) charcoal or dry sawdust to assist in keeping the room cool. A good cement floor ought to be laid, with sufficient fall to allow all water to flow off easily into the drain.

The Curing Room.—The curing room may be constructed similarly to the making room, but both walls and ceiling must be insulated. A badly-constructed curing room may ruin even the best manufactured cheese. A curing room of the dimensions given should have at least two windows, and these should be double ones, so that there will be a dead air space. They should be hinged, opening outwards like a door, and should be fitted with felt around the sash to ensure absolute tightness when shut.

An Underground Curing Room.—Probably the best plan is to build the dairy so that the curing room constitutes a sort of cellar (see Fig. 2), three sides of the lower half of the building being then entirely covered with earth (except perhaps for spaces for small windows), and the fourth (which should face the south) covered, except for the portion occupied by the doorway. When the building is constructed on a slope this is easily accomplished, there being comparatively little excavating to do, as the soil removed can be thrown against the building.

To build this cellared structure, it is necessary to construct the underground half (the portion to be in contact with the earth) either of reinforced cement or brick, taking care to finish off the outside of the walls as presently described before actually banking up the soil. Allowance for ventilation of the curing room should be made while the underground halves of the walls are in process of being built, and this is best done by building in two bends of galvanised tin pipe 6 to 8 inches in diameter, pieces of straight pipe sufficiently long to reach beyond the eaves of the completed building being added to these subsequently, and the inlet shaft furnished with a cowl. Any portions of the shafts to be covered with earth must be painted with biturine or tar. The cellar walls should be furnished with a damp-course, and they should finally be covered on the outside (when sufficiently dry) with a special tar preparation to keep out the moisture, and floated on the inside with cement, finished off perfectly smooth. The cellar door should be of cement: it should have a good surface and be provided with a tile drain with a trap inlet, so that rats and mice may be kept out and bad smells prevented from rising.

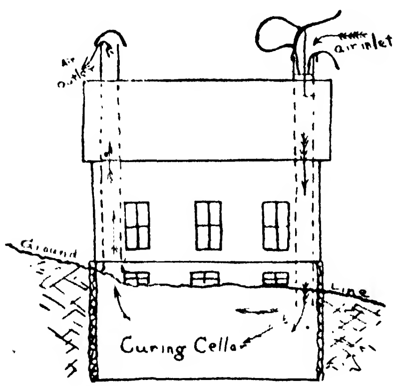


Fig. 2.—Curing room, partially underground; showing the system of ventilation for the cellar.
(*After Decker*).

The brick or cement portion of the walls properly set, the construction of the making room is proceeded with, stairs, of course, eventually connecting the two rooms. As the top half of the building (the making room) will not be in contact with the earth, the walls of this portion may be of timber, but these walls, as well as the ceiling, must be constructed on the lines already described. The ventilator shaft inlet to the cellar should be fitted with wire gauze and a shutter for use on very hot days.

The building of the curing room on a partially underground plan has been particularly described, but while such a plan is to be preferred, there is no objection to the dairyman building entirely above ground so long as he takes every care that the construction is on efficient lines. For a curing room built above ground the system shown in Fig. 3 may be recommended as effective in keeping down the temperature.

The curing room shelves should preferably be of well-seasoned white pine or kauri, and should be rather wider than the diameter of the cheese (about 15 inches wide for 40 lb. cheeses, and 8 inches for 10 lb.). They should be made in one piece or they are liable to leave a ridge on the cheese.

Some General Requirements.

A verandah about 6 or 8 feet wide should be provided; if the curing room is on the ground level it may run entirely round the building. One side at

least of the verandah should be concreted, and the washing-up tub should be situated on this. Any remaining verandah space may be beautified by a few tree and stag-horn ferns, and in some handy space there should be placed a storage cupboard for salt.

It has been proved that one of the best and cheapest germicides is sunlight; in the making room particularly, therefore, there should be large windows. Windows, doorways, and all openings into the making room must be fly-proof, in compliance with the Dairy Industry Act.

Ventilation has already been mentioned in connection with the curing room; the ventilation of the making room should be provided for by ventilators cut in the ceiling; not, however, immediately over the making vat. These ventilators should be covered with gauze, and should be boxed over for about 18 inches on top as a protection from any falling sawdust or charcoal. In each gable end there should be a louvre at least 3 feet square, covered with very fine wire-netting.

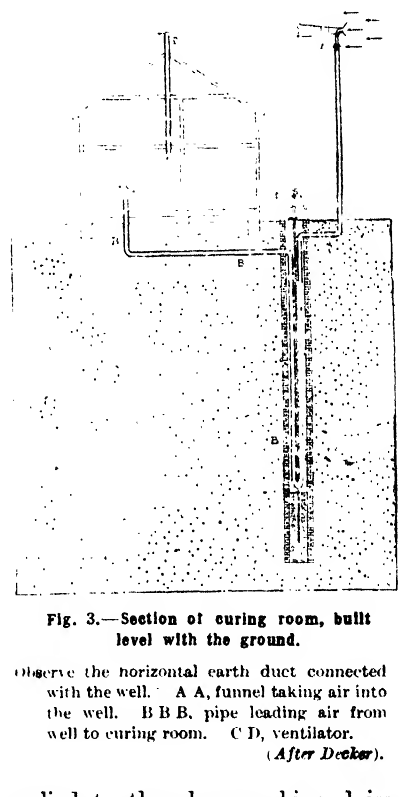


Fig. 3.—Section of curing room, built level with the ground.

Observe the horizontal earth duct connected with the well. A A, funnel taking air into the well. B B B, pipe leading air from well to curing room. C D, ventilator. (*After Decker*).

Probably shingles make the coolest roof, but there is a certain objection to their use unless made of a special wood, owing to their effect on rain-water coming in contact with them. Fibro-cement slates make good roofs, but their use is costly. Iron, though not so cool as shingles, may be regarded as a sufficiently satisfactory roofing material. Guttering must, of course be erected for the conveyance of rain-water to a tank.

Wash-water constitutes sewerage as applied to the cheesemaking dairy. It is always advisable to provide an open concrete drain (at least 9 inches wide at the top to allow of easy cleansing) for the disposal of this. The drain should be so placed that all the washings will flow readily into it; the fall should be good and the outlet should be into a covered cesspit situated a fair distance from the factory, where, if the ground is porous, the water will readily soak away. The pit should measure about 4 by 4 by 4 feet, and on an ordinary farm dairy such a pit should last for years. If the water does not drain away rapidly enough, a second hole should be dug near the first and the two connected. If the ground is of a very non-porous nature, three holes of the size specified should be dug alongside in such proximity that only walls of earth 2 feet thick separate them. Through these dividing

walls, about 6 inches from the top, is run a connecting length of 2-inch piping, and from the bottom of the third hole, which must be almost filled with sand or gravel, is run a pipe out into the open. The walls of the holes should be lined with wood for about a foot down to prevent them from crumbling in, and each should be covered with timber and finally with a layer of earth. The water enters the first hole from the drain; the greater proportion of the sediment settles to the bottom of the hole, and the water gradually rises to the level of the outlet into the second hole. Thence it passes into hole No. 3, and so filtered and purified has it become by the time it has drained through this that there is little danger from letting it run off over the ground adjacent to the outlet pipe.

A good pure water supply is necessary for the cheesemaking dairy. Roof water can be collected; and the supply from a well is frequently satisfactory, though it is often brackish and liable to cause corrosion of utensils (particularly the boiler). When a gravitation supply can be obtained, it is, of course the best. Water from dams is unsuitable either for use in the dairy or for the cows' drinking supply. Stagnant water is one of the greatest sources of contamination.

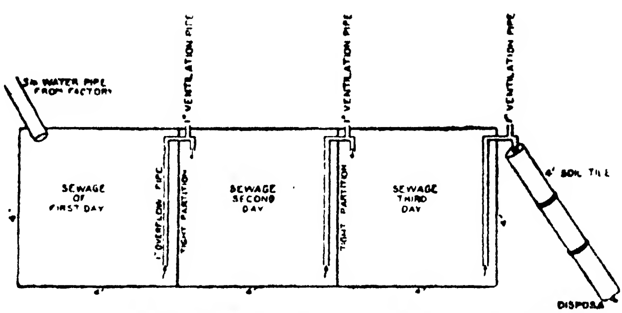


Fig. 4.—Series of cesspits, capable of treating sewerage from a factory dealing with the milk of seventy cows.
(*After Van Slyke*)

Plant Required.

Financial considerations will sometimes be a limiting factor in the purchase of plant for a farm dairy, but some articles are absolutely necessary. Following is a list of these, and it is recommended as an economy that they be of the best quality, for cheap tinware is soon corroded by the acids of whey and milk.

One 2-h.p. boiler (a 4-h.p. boiler would be better).
One oblong 200 gallon jacketed making vat with racks, curd-strainer, and rake.
Two curd knives.
One cheese press (either vertical or horizontal).
One curd mill.
Four 40 lb. tinned steel hoops.
Eight 10 lb. " " "
One 5 lb. " " "
One 3 lb. " " "
One pair of scales to weigh 5 cwt.
Two thermometers (one guaranteed accurate, to be kept for testing others.

Acid testing outfit, curd scoop, curd bucket, rennet, colour, bandage, caps, scrubbing brush, broom, &c.

The total cost of such a plant would be from £160 to £170. Opportunities often occur, however, of getting second-hand presses and mills in good order at much lower prices. Where wood is plentiful a large copper, to hold, say, 100 gallons, can be used in place of a steam boiler. This copper should have a pipe connected into the bottom to convey the hot water to the cheese vat; it should be built in with bricks and should be set high, so that the water will gravitate from it to the dairy. Such an arrangement is suitable only when a small quantity of cheese is made; for a fairly large dairy a copper cannot be compared with a steam boiler for cleanliness or convenience.

(To be continued.)

Plants which Produce Inflammation or Irritation of the Skin.*

Mr. A. J. Pinn, Inspector of Agriculture, referred to me Mr. Charles White, who had undergone much irritation of the skin of his arms caused by handling parsnips (*Pastinaca sativa* L.), the foliage of which continually brushed his fore-arms. This is the second occasion on which he has been troubled by this irritation. It remains for from three to four weeks, and during that time he has numerous watery blisters. Two other persons were similarly affected by the foliage of the parsnips.

I may say that I saw Mr. White, and he exhibited the skin irritation, and from what he tells me I am quite satisfied that in all three cases the foliage of the parsnips was the cause of the trouble. The scene of the occurrence was the West Maitland district, N.S.W.

So far as I know, no previous record of parsnip irritation has been recorded in Australia, and I find the following references in L. H. Pammel's "Manual of Poisonous Plants," pp. 126 and 663.

Persons are often poisoned by handling the plant, which causes inflammation and vesication. Mr. F. C. Stewart, in a letter to the writer, states that in one case the eyes became swollen; vesication occurred from poisoning caused by the flowers.

That the parsnip does at times produce dermatitis has been proven. The following very interesting letter from Professor F. C. Stewart, botanist of the New York Agricultural Experiment Station, is of interest in this connection:—

I recollect that some fifteen years ago you were much interested in the reputed poisonous properties of the wild parsnip, and that you reached the conclusion that wild parsnip is not poisonous. I think you may be interested to know of an instance which has recently come to my attention. Henry Van Dreser, a prominent lecturer on poultry in this State, last season had a very serious injury to his face and eyes. His face became badly swollen and his eyes were in a terrible condition. It was feared at the time that they would be ruined, but the sight was not lost, although it was considerably impaired. The physician in charge diagnosed it as a case of poisoning, due probably to the flowers of wild parsnip. Very shortly before the trouble appeared, Mr. Van Dreser had been mowing a large patch of wild parsnip which was in bloom. It was a hot day, so that he perspired profusely. He gathered bunches of the wild parsnip plants in his arms and carried them. This brought the plants in contact with his face. Both Mr. Van Dreser and the physician feel confident that the wild parsnip was the cause of the trouble. Another gentleman who heard of this case told me that some years ago he lost a little girl with poisoning of a somewhat similar character, and it was attributed to the parsnip blossoms, amongst which the little girl had been playing immediately before the attack.

The writer has also known of a few cases of dermatitis produced by this plant. Poisoning similar to the above may be produced by other members of this family, notably the cowbane A young high school lad in Boone lost his life in a way similar to that from *Pastinaca sativa*.

—J. H. Maiden.

*Previous reference, this *Gazette*, March, 1921.

Horticulture.

E. N. WARD, Superintendent, Botanic Gardens, Sydney.

The Kinds of Trees to Plant.

NOT the least important consideration in planting trees for shade and effect in parks and reserves, or for shade and shelter for stock, is the choice of the right kinds. Planting close to the sea, but with shelter on the ocean side, is quite a different matter to planting on the ocean front. The low-lying areas, or those under 300 feet above sea-level, must be content with a smaller assortment than is available for higher altitudes. Nor can residents of coastal areas expect to grow the beautiful native trees of the western plains; neither will the plains raise the rich vegetation of the coast, however kind the cultivation might be. Districts with long frost periods must have special consideration, and all these several considerations are varied by exceptions, some districts having a large range of possibilities. For instance, the huge exhibit staged by the Northern Rivers' district at the last Royal Agricultural Show showed a range in fruit from the banana to the gooseberry.

Whenever any extensive planting is being considered, careful note should be taken of trees that are already growing well in the district in private or public places, and failing evidence of this kind, the advice of experts should be obtained.

Soil is another consideration, and sometimes aspect counts for a good deal; although these affect only certain families of trees, it often happens that from the many suitable subjects available, it is the exception that is chosen, with inevitable disappointment. Many who have admired the sugar gum (*Eucalyptus cladocalyx*) growing in the interior at such places as Leeton, on the Murrumbidgee Irrigation Area, have been led to plant them near Sydney, where they grow rapidly for a time but are not many years old before they begin to show how unhappy they are, owing to the ravages of the preying insects that usually attack the foliage of trees out of their natural environment. Many who visit Western Australia when the scarlet and crimson flowering gums are ablaze, come back with a determination to have some in their own locality, but they invariably get a row of uneven, unshapely trees altogether unsuited for street planting in the eastern states, though for group planting or as isolated specimens round the homestead they are capable of contributing colour to the landscape.

Qualities a Street or Road Tree must Possess.

It may be said that Sydney and its suburbs may be made to grow anything in the way of trees that will grow in Melbourne and Brisbane, so accommodating is the climate. You may see as fine an oak tree in the Sydney Domain

as any to be found in Melbourne, and just as good specimens of sub-tropical figs or *Ficus* as in Brisbane; but it does not necessarily follow that such trees will be suitable for avenue purposes.

Straightness of trunk and symmetry of branches, immunity from insect pests, the right amount of shade at the time of the year when shade is most wanted, submission to severe pruning in centres where overhead wires still appertain, must all be considered in selecting trees for planting. Cleanliness is another consideration, and by this it is not meant that deciduous trees should be discarded, for they make an ideal street tree for our climate, providing a maximum density of shade in midsummer, and allowing the sun to warm and dry the pathways in winter. There are trees, however, that are continually discharging either bark, leaves, twigs, flowers, or fruit and which keep the paths in a state of untidiness and even of danger. Neither should tempting fruit or showy flowers be encouraged in the street or public places. Finally, the longevity of a tree must be considered. Often short-lived trees are chosen because they grow quickly, for. unfortunately, the long-lived kinds are not always quick growers. It is not surprising, therefore, that the range of choice for any particular purpose, whether in the city, suburb, or country, is extremely limited.

For Sydney and places with similar Climate.

The plane trees (*Platanus orientalis* or *P. occidentalis*) are difficult to beat when properly planted. Those round the central railway station at Sydney are an object-lesson in city street planting.

Higher above sea-level the deciduous sweet gum of Canada, sold under the name of *Liquidambar styraciflua*, should be planted. This tree is even more symmetrical than the plane and has the advantage of coloured foliage in the autumn. Perhaps there has not been a greater demand for it for street purposes because, to the Australian, its maple-like foliage does not in any way resemble a gum, while its shop name is too long for words.

Probably the most popular is the brush box, *Tristania conferta*, sometimes sold as *Lophostemon australe*, an evergreen and a native of the State. The above three are rapid growers.

In good soil the Cape chestnut *Calodendron capensis* will fulfil every condition required of a street tree, and bears a mass of beautiful flowers, which however, are not useful for cutting purposes. It possesses shapely outlines. and is only partially deciduous. In heavy soil our native turpentine (*Metrosideros glomulifera*) makes a handsome tree; its dark evergreen foliage is always attractive, and requires little training. *Ficus Hillii*, when better known, will probably become one of our most favoured street trees; it has bright green foliage, good upright habit, with a whitish trunk. This plant is sold by some as *Ficus nitida*.

Where upright-growing trees have to be preferred, the following three are recommended:—The native plum tree (*Podocarpus elata*), an evergreen, pleasingly foliaged tree, bearing a small fruit with the colour and bloom of

plums; the wheel tree, thus named because its flowers resemble wheels (sold as *Stenocarpus sinuatus*, and erroneously as *Cunninghamii*), has bright evergreen oakleaf foliage, growing upright like the native plum (*Lagunaria Patersonii*) with small pink hibiscus-like flowers and greyish evergreen foliage.

Where the altitude reaches above the 300-feet mark, the pin oak of America (*Quercus palustris*), the red oak (*Quercus rubra*), and the scarlet oak (*Quercus coccinea*) are worth while. Where good soil and proper cultivation can be given, the live or evergreen oak makes a handsome tree for wide street shade purposes. This is sold under the name of *Quercus virginiana* (sometimes as *virens*).

None of the above should be planted less than 30 feet apart—in most cases 40 feet would be better—and they should be planted alternately on the two sides of an avenue: that is, the trees should not be opposite each other, so that the shade shall be more evenly distributed. The ideal is to let each tree grow into a specimen, not into each other.

Three trees for suitable stock shelter are the coral *Erythrina indica*), the honey locust tree (*Gleditschia triacanthos*), and the pepper tree (*Schinus molle*).

Next month lists will be given of trees suitable for coastal places, for the extreme west, and for the cold tablelands.

Some Trees and Plants of Value to Bee-keepers.

There are, no doubt, some thousands of species of flowering plants which are of assistance to the apiarist, but the value of only a proportion of those has so far been determined. The following, however, have been proved to be of definite help in varying degrees :—

Inland districts generally.—Eucalyptus: Yellow box (*Eucalyptus melliodora*), white box (*E. hemiphloia*, var *albens*), red box (*E. polyanthemos*), red gum (*E. rostrata* and *E. tereticornis*), white gum (*E. coriacea*), sugar gum (*E corynocalyx*), stringybark (*E. capitellata* and *E. macrorrhyncha*), apple-box (*E Stuartiana*), peppermint (*E. radiafa* and others), and woolly-butt (*E. longifolia*). Other trees, plants, and shrubs: Tree lucerne (*Cytisus proliferus alba*), black thistle (*Carduus officinalis*), pepper tree (*Schinus molle*), Cootamundra wattle (*Acacia Baileyana*), golden wattle (*A. decora* and others), silver wattle (*A. dealbata*), blackberry (*Rubus fruticosus*), various fruit trees, Cape weed (*Cryptostemma calendulaceum*), clover (*Trifolium repens*), lucerne (*Medicago sativa*), maize (*Zea mays*), and pumpkin vines.

Coastal districts generally.—Eucalyptus: Grey ironbark (*Eucalyptus paniculata*), broadleaf ironbark (*E. siderophloia*), grey gum (*E. propincua* and *E. punctata*), spotted gum (*E. maculata*), white gum (*E. haemastoma*), flooded gum (*E. grandis*), swamp mahogany (*E. robusta*), red mahogany (*E. resinifera*), bloodwood (*E. corymbosa*), and tallow-wood (*E. microcorys*). Other trees, plants, and shrubs: Silky oak (*Grevillea robusta*), tea-trees, orange trees, clematis (*Clematis glycinoides*), maize (*Zea mays*), pumpkin vines, clover (*Trifolium repens*), black thistle (*Carduus lanceolatus*), wattles, and dandelion (*Taraxacum officinale*).—W. A. Goodacre, Senior Apiary Inspector.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of wheat, oats, maize, sorghum, Sudan grass, potatoes, and other crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

The list is compiled after inspection of the seed and report by a field officer of the Department (preferably during the growth of the crop), and farmers who have pure high-class seed of good quality of any variety of farm crop are invited to communicate with the Under Secretary and Director, Department of Agriculture, Sydney.

The Department does not undertake to buy any of the seed.

****Sudan Grass* :— ... .**	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Temora.
	J. Cavanagh, Curlewis.
Clovers :—	
Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
Maize :—	
Golden Glow	J. F. Chick, Hillview, Tenterfield.
Wellingrove (formerly Early Yellow Dent).	Manager, Experiment Farm, Glen Innes.
	J. S. R. Crawford, Emu Swamp, Orange.
Iowa Silvermine (formerly Silvermine).	Manager, Experiment Farm, Yanco.
Funk's Yellow Dent	Manager, North Bangaroo Stud Farm, Canowindra
Boone County White	J. Chittick, Kangaroo Valley.
Leaming...	Manager, Experiment Farm, Grafton.
Golden Beauty	R. Richardson, Mondrook, Tinonee, Manning River.
Manning Pride	S. Smith, Karaak Flat, via Wingham.
Golden Nugget...	J. W. Smith, Wauchope.
Manning White	A. McM. Singleton, Henley, Sydney.
Large Red Hogan (formerly Red Hogan).	Principal, H. A. College, Richmond.
Craig Mitchell	W. D. K. Humphries, Muswellbrook.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy (formerly Improved Yellow Dent)	D. J. Dorward, Tayfield, Cundletown.
	J. C. Dull, Mount George.
	P. Mooney, Dumaresq Island, Taree.
	W. Richardson, Dumaresq Island, Taree.
	A. McM. Singleton, Henley, Sydney.
Goldmine	A. Louttit, Moruya.
Yellow Moruya	A. Louttit, Moruya.
Golden King	E. Blackburn, Warkton, Coonabarabran.
Manning Silvermine	R. Dyball, junior, Taree Estate, Taree.
***Grain Sorghums* :—**	
Feterita	W. D. K. Humphries, Muswellbrook.
Manchu Kaoliang	Manager, Experiment Farm, Bathurst.
***Sweet Sorghums* :—**	
Saccaline...	Principal H. A. College, Richmond.
	Foreman, Veterinary Station, Glenfield.
***Millet* :—**	
Japanese	Manager, Experiment Farm, Coonamble.

* Sudan grass should not be sown until all danger of frost is passed.

PURE SEED—*continued.*

Potatoes :—	
Satisfaction	O. E. Silk, Nimmitabel.
	J. D. Morse, Black Mountain.
Surprise	O. E. Silk, Nimmitabel.
Lucerne :—	
Coolah	R. J. Crossthwaite, Pilca Butta, Leadville.
Peanuts :—	
White Spanish	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm, Yanco.
	Manager, Experiment Farm, Lismore.

In addition to those tabulated a number of crops were inspected and passed, but as the growers failed to forward samples their seed has not been listed.

NOTE.—The Department of Agriculture has a small quantity of miscellaneous seeds, such as velvet beans, cowpeas, soy beans, pop corn and sweet corn, for distribution to farmers, and can also supply samples of several varieties of field maize for trial (including some new varieties from America and Africa). Application should be made to the Under Secretary and Director, Department of Agriculture, Sydney.

TO MAKE LEMON OR LIME JUICE.

To make lemon or lime juice, the fruit is peeled and pressed, and after the removal of the pips, the juice is filtered from the pulp by squeezing in linen bags. While still fresh the juice is heated, and when cool, shaken up with a little talc, which will settle and can be filtered off. In order to preserve it, 10 per cent. of sugar is added to the juice, and it is then boiled for ten minutes; while still boiling, or nearly so, it is poured into sterile bottles and corked at once.

If a more concentrated juice is required, it can be obtained by evaporation after the processes of clarification and evaporation.—A. A. RAMSAY, Principal Assistant Chemist.

HORTICULTURE IN WESTERN AUSTRALIA.

UNDER the title "The Handbook of Horticulture and Viticulture of Western Australia," the Department of Agriculture, in the western State (with Mr. A. Despeissis, M.R.A.C., as author) has made available for its own fruit-growers a volume of 647 pages which touches pretty well every aspect of the subject. The first few pages inform us that all who have paid attention to the facts firmly believe that Western Australia "bids fair to eclipse the other States of the group as a fruit-producing territory." Its soil is virgin and ready to welcome a change from the age-long occupation of gum trees, its climate is consistent, it has the advantage of the experience of other Australian growers, is situated 1,200 to 2,000 miles nearer European markets, and offers a ready local market at profitable prices.

With such opportunities, fruit-growing should thrive in this new land of the west, and the present book, practical, comprehensive, and business-like, reflects the variety of fruits the country will grow, presents the most profitable methods, and describes and illustrates the fungus diseases and insect pests that have to be dealt with. The book has a very usable appearance, and certain defects in the sequence of the different articles are no doubt largely corrected by the very copious index.

Vineyard Notes for September.

H. L. MANUEL, Viticultural Expert.

Preparations for the Spraying Season.

WE are now approaching a period when all spraying apparatus should be overhauled and put in order, and arrangements made for supplies of bluestone and lime, so that the necessaries of the spraying season may be on hand in good time.

Downy mildew under favourable weather conditions is such a quick mover that if left unchecked it can do an enormous amount of damage in a very short space of time. The object of the spray is to kill the spores as they alight on the vine, and so to prevent penetration and germination inside the plant tissues.

No risks should be taken as regards spraying. Gambling on weather conditions is a foolhardy policy. Nor will any sound business man consider the infinitesimal cost of spraying, compared with the loss likely to attend neglect of this work.

Last season, in some parts of the State where spraying had been neglected, the ravages of this disease were heart-breaking. On several vineyards hardly a berry was vintaged. In the face of this, it behoves every grower for his own and his neighbours' good thoroughly to attend to the spraying operations.

Marking Out.

It is necessary for almost obvious reasons that a vineyard be set out on regular and symmetrical lines. Irregularly spaced rows (or vines in the row), and rows that are not strictly parallel, greatly hamper the subsequent operations of surface cultivation and spraying. To a person with any sense of accuracy a badly laid out vineyard is an eyesore.

The chain, or strictly speaking, wire method is to be preferred over all others for accurate results. The materials required are two lengths of No. 10 or 12 galvanised wire, a dozen sight pegs 4 feet 6 inches in length, two 2½ inch diameter iron rings, and two 3 feet x 1½ inch pointed iron or steel bars.

The planting wires are made by threading on to them small discs punched out from pieces of tin, and lightly straining the wires on a flat surface. The discs are soldered on to the wires at the distance apart one wishes to plant the vines. A suitable spacing in the vineyard is 8 feet x 11 feet, and to this end discs should be soldered on one wire at 8 feet apart and on the other wire every 11 feet. The iron rings are tied to the ends of the wires, and the iron bars (for holding the wires in position and for tightening them), are driven through the rings into the ground. White paper wrapped around the tops of sight pegs will prove an assistance in sighting.

The first step is to decide upon the width of the headlands, and where it is intended to plant a considerable area warranting the use of a large team, headlands should be left at least 25 feet wide. With small areas, say 10 to

20 acres, where only a small team will be necessary, a headland 20 feet wide will be sufficient. Then sight the base lines, using the sight pegs referred to, marking out one line at right angles to the other. This is easily done in paddocks that have been fenced on the square by simply taking the base lines off parallel with the fences.

In sighting, erect the sight pegs at a distance apart a little short of the length of the wire, so that the wire may be placed flush up against the sight peg. Straighten the wire, slightly strain it with the iron peg, and then drive the peg into the ground. Drive a vine stake into the ground at every soldered disc and continue chaining and staking until the base lines are complete. The area now squared off can be easily divided up and pegged out in blocks until the whole area is finished. If at any subsequent date it is desired to extend the area it can be done by continuing the base lines. In dealing with paddocks other than those having fences at right angles, set out first the greatest possible rectangular figure, and fill in the angle ends by means of the use of the sighting pegs and planting wire or tape.

Planting.

Before planting out the young vines, prune them to a spur of two buds, and cut off all roots along the stem with the exception of the bottom ones, which should be cut back to a length of about three inches. The rootlings can be conveniently carried by the planter in a bucket made from a kerosene tin, quarter-filled with water to keep the rootlings from drying out. A long-handled shovel is an excellent tool for planting with. The hole for the planting is made alongside of the stake, and a little surface soil is placed in the bottom of it. The vine is now placed in the hole as close as possible to the stake, and so that the union of the graft is just above the ground level.

In filling-in, heel the soil well around the roots and mound over in case of grafted rootlings, so that the earth comes to just above the top of the spur. This mound protects the graft and should be removed after the vine has satisfactorily struck. Remove any scion roots that appear, and throughout the growing season disbud any American wood that may grow. At the following season's pruning in nearly every case it will be necessary to reduce the wood of the vine to one spur of two buds again. Only in exceptionally strong vines should the stem be formed.

It is advisable to have a stake at every small vine, not only for the protection it affords, but also to guide the teamster when cultivating, especially if the soil is covered with weeds that are likely to hide the young growth.

THE first attacks of thrips on roses can be considerably checked by spraying with tobacco and soap mixture. It has also been found that when they are attacking the open roses, by going round with a bucket containing kerosene and water, and pinching off all open blooms that are swarming with thrips and dropping them into the bucket, the pest can be very much reduced, and the later roses very much freed from them. The thrips feed upon the pollen and the base of the petals, and thus cause the flowers to fall to pieces before they come into full bloom.—W. W. FROGGATT, Government Entomologist.

Poultry Notes.

SEPTEMBER.

JAMES HADLINGTON, Poultry Expert.

IN all but the very coldest districts of the State the close of this month should bring with it the close of the hatching season, and the "experience-wise" poultry-farmer will see to it that no eggs are set after the first week in this month. The why and wherefore of closing the hatching season at this point has many times been stated in these notes.

The Season's Hatching.

The results of this season's hatching appear, with few exceptions, to have been most satisfactory on the whole, fair to high percentages of chickens having been the rule. Unfortunately, the same cannot be said of the laying results, which have probably been the worst experienced during the winter months for many years. This, too, has followed upon generally poor average results from pullets during the autumn. These factors, together with the high cost of feeding that has prevailed for a long period, has had a most depressing effect upon the industry. Fortunately, however, poultry foods are now commencing to come down somewhat in price, and should this tendency continue, and foodstuffs reach something like a normal level, and should the prospects of an export trade improve at the same time, a big impetus will be given to poultry-farming.

The Growing Chickens.

It should be obvious, but it is worth stating as a reminder, that the months we are now in are the period during which the poultry-farmer can make or mar the prospects of his farm for next year. His egg-yield then will be very largely determined by the development secured in the chickens being raised now.

Allowing that a known profitable breed has been taken up, there are two main factors upon which we are absolutely dependent for success in egg-production. These are good breeding and good development. Without the latter the former fails to find expression in results.

Let it not be thought that the factor of development is unduly stressed in these notes. My observations over a wide field of activities in poultry-keeping leads me to the conviction that lack of proper development is the worst feature in the poultry industry, and it is safe to say it is the cause of most of the failures that occur in poultry-farming. My estimate is that a 25 per cent. all-round increase in egg-production would follow better development in the growing stock on many farms. The apparent difficulty is that many who go into business as poultry-farmers take years to learn to differentiate between good and bad development, yet this knowledge is absolutely necessary to success.

The question that every poultry-farmer should repeatedly ask himself during the rearing season is, "Are my chickens making the growth they should be doing?" and if the answer is not satisfactory the cause should be investigated with a view to securing an improvement. The cause of non-success in this respect will most likely be found in faulty brooding or unskilful feeding.

As a guide in this matter, it might be stated that unless 6½ oz. weight has been secured at four weeks old, and 14 oz. in pullets, and 16 to 22 oz. according to breed in cockerels at eight weeks old, the development is not quite what can be classed as good. As a matter of experience, any lack of growth during these early stages is rarely, if ever, made up later on, and the chicken is handicapped throughout its life.

The Main Factors.

The main factors in securing good growth are (1) heredity, (2) brooding, (3) feeding.

In regard to the first, we must have good breeding stock, which has been properly grown to standard size. Secondly, good brooding is absolutely essential to secure proper growth. Thirdly, in feeding it is not only necessary that good food be fed, but that it be skilfully fed. The main point is so to feed the chickens that they will eat the maximum amount of food, but, contrary to what many appear to think, keeping food always before chickens is not the way to induce the keenness of appetite that is necessary to the consumption and assimilation of the largest amount of food.

The farmer who secures the best development in his growing stock is not necessarily the one who is always endeavouring to follow all the latest so-called scientific treatises on feeding, or who feeds on highly concentrated food. As a matter of fact, a too narrow ration might induce early maturity, but not necessarily the desired growth. Maturity should not be confused with growth. For instance, we might have a mature bird very much lacking in the desired development, and it is this feature that is at the root of much of the degeneracy so much in evidence, and one of the main causes of smallness of egg, about which so much concern is being manifested at the present time.

The farmer who feeds on simple fare, such as advocated by the Department in "Rearing and Feeding," who exercises sound judgment, and is not afraid of the small amount of labour necessary to mix an appetising mash two or three times a day, is the one who, other things being equal, obtains the best results from his feeding, both in regard to cost and results.

Reminders for Brooding.

The main considerations in rearing chickens might be summed up as under:—

1. Heated brooders should be kept well up to the temperatures so often advised in these notes and in the publication already referred to. Underheating will lead to trouble, because it results in the chickens packing together. Start the chickens at a temperature of 90 to 95 degrees, and reduce it by about 3 to 4 degrees per week.

2. Good ventilation is absolutely necessary, and this can only be secured when the heater is capable of supplying the necessary radiation to allow of the admission of pure air.

3. A moist area on the floor of the brooder is an indication that chickens have packed together during the night. Deficiency of warmth is the cause. Chills and their after-effects are the results.

4. An unpleasant smell when the brooders are opened up in the morning is often the forerunner of trouble, and is an indication that better ventilation is necessary.

5. Chickens of different ages should be kept separate. Even a week's disparity in ages will be sufficient to stunt the growth of the younger ones. Successful rearing cannot be expected with mixed ages, and particularly so with those under six weeks old.

6. When chickens are seen with bare heads, and are feathering badly, it is generally an indication that they are crowding at night.

7. When chickens droop their wings and are less keen for their food, it is a sure sign that something has gone wrong. It may be due to a chill or actual disease. The first is generally the forerunner of the second, because the vitality of the chicken has been lowered by a condition which leaves it vulnerable to the disease germs that are always more or less present.

8. A sharp look-out should be kept for suck louse on the heads of the chickens. These are a very common cause of trouble. On the first sign of droopiness the chickens should be examined, and if this parasite is found the slightest touch of olive oil (nothing stronger is necessary) will kill the parasite; repeat it in eight days' time. Disinfecting brooders is no use for this trouble. Every chicken must be handled and treated.

9. Toe-picking is one of the most troublesome happenings in rearing chickens. This trouble can be avoided by a moderate use of common salt in the wet mash with which the chickens are fed for the greater part of the day. The right quantity to use is 1 oz. to each 5 lb. of mash. The salt must be thoroughly dissolved in the liquid with which the mesh is mixed, and there is no danger of salt-poisoning if this is done. If milk can be used for mixing the mash it will be so much more effective.

10. Thin out and weed out the chickens as they grow. Congestion in the brooder means poor development and risk of disease.

11. Over-hatching is responsible for many failures.

12. Keep the chickens growing from the shell without a check. This can be done by close attention to the details enumerated above, and profitable stock will be the result.

THE FREE ISSUE OF THE *Agricultural Gazette.*

RECIPIENTS of the *Agricultural Gazette* are reminded that if they wish a continuance of the free issue, they must fill in and return without further delay, the slips lately posted to them.

Orchard Notes.

SEPTEMBER.

W. J. ALLEN and S. A. HOGG.

WHERE ploughing is not completed, it should be finished with as little delay as possible, and the cultivator should be continuously kept going throughout the growing period of the trees and vines, so as to retain the winter rains and assure sufficient moisture for the development of the fruit.

During this month most fruit trees will be blossoming, and in some cases in the early districts they will have finished blossoming. In the case of apples and pears, strict attention must be given to spraying, the applications of arsenate of lead for the control of codlin moth being given when the petals have dropped from the fruit. This "calyx spray" is a most important one, and should be thoroughly carried out. The operator should not aim at economy, but should give the trees an excess of spray rather than an insufficiency.

Where black spot and scab in apples have made their appearance, lime-sulphur or Bordeaux mixture may be combined with the arsenical spray and applied at the same time. In some districts it has been found that Bordeaux mixture may have a russetting effect upon fruit, while in other districts it has not this effect. Lime-sulphur has been found to give uniform satisfaction, but in any case where lime-sulphur fails, then Bordeaux mixture should be given a trial, say, on a few trees, so that its effectiveness may be determined.

During this month scale insects, such as San Jose, may become active on such trees as peaches, plums, and perhaps apples and pears. With peaches and plums, lime-sulphur at winter strength may have a defoliating effect upon the trees; yet unless used at that strength it will not kill the scale. It would be better, therefore, to spray with a resin, soda, and soap wash.

If the trees are not vigorous and robust, it would be better to leave the spraying until after the fruit has been removed.

Woolly aphis on apples and pears may be kept in check by the application of nicotine preparations during either summer or winter, but care should be taken to carry out accurately the instructions given on each package.

Dusting.

The Department has received frequent inquiries as to whether dusting is more effective or has any advantage over spraying. From information received, principally from America (where in some districts this method has been given extensive trials), it has not proved generally satisfactory, as the same trouble arises in dusting as in spraying, only in a greater degree—that is, the weather conditions are generally unsuited for dusting because of winds. Dusting has not become a popular method of combating pests, whereas spraying has given more uniformly successful results.

Agricultural Bureau of New South Wales.

REPORTS AND NOTICES FROM BRANCHES.

NOTE.—While gladly publishing in these columns the views of members of the various Branches of the Agricultural Bureau, the Department does not necessarily endorse the opinions expressed.

Auburn.

Mr. L. S. Rumble, of Lidcombe, attended the July meeting of this branch and gave valuable information on the cottage-garden, particularly the vegetable portion.

Bullahdelah.

A branch of the Bureau has been formed at this centre with the following office-bearers:—Chairman, Dr. Kersteven; Vice-chairman, Mr. A. H. H. Ireland; Treasurer, Mr. J. Richards; Hon. Secretary, Mr. J. B. Watson.

Cardiff.

The monthly meeting was held on 16th July, when it was decided to purchase a 5-lb. keg of arsenate of lead for distribution among members at cost price. A useful discussion on co-operation followed, and delegates were appointed to attend the meeting of representatives of branches of the Bureau in the district.

Coonabarabran.

At a meeting on 2nd July formal business was transacted, and requests were made to the Department for various experts to visit the district and deliver lectures. It was decided to ask the Railway Commissioners to allow a pass for an attendant accompanying one truck of stock, as is at present done with three trucks from one owner.

Coradgery.

The members of this branch met on 6th July, and arranged a programme for the visit of the Select Committee on Agriculture. It was agreed to act in conjunction with other farmers in preparing evidence for the Committee.

A seed-wheat competition is to be held by this branch, and a proposal to start a sports club (including the possible construction of three tennis courts) is also receiving attention. A picnic luncheon is also to be held shortly.

Cotta Walla.

A pruning demonstration was given by Mr. S. A. Hogg, Assistant Fruit Expert, at Mr. J. Kadwell's orchard on 8th July, a number of varieties of apples and pears being dealt with, and members unanimously testifying to the value of the advice given.

At a meeting on 25th July, Mr. J. E. O'Neill gave an address on the care of cream, advocating cleanliness with all utensils at all stages, describing the cooling of various batches, and touching also on mixing, stirring, and ripening. Mr. O'Neill also offered to give instruction in the use of the Babcock tester to anyone who wished it. It would be quite sufficient for two neighbours to purchase one tester between them, and to use it in alternate weeks.

Cunningar.

At a meeting on 22nd July, Mr. B. J. Hocks gave a lecture on noxious weeds. He urged farmers to act promptly in relation to such pests, and thus save heavy labour in subsequent seasons.

Dapto.

On 7th July, Mr. C. O. Hamblin, Assistant Biologist, lectured on red stain in sorghum and other fungus diseases.

Some Fungus Diseases of Plants.

Mr. Hamblin said red stain was a fungus disease which could be conveyed in the seed, through the soil, or by the air. All were familiar with the manner in which affected canes turned red. Eventually the value of such crops was much impaired. Sorghums, millet, and Sudan grass were all more or less affected. Clean seed of a broom millet was obtained from Kew Gardens, London, and clean seed of eight varieties of sorghum was imported from America, but when planted on Mr. F. James' farm in the district all except one variety had come up diseased. That one variety gave some prospects of resisting the disease. Plants from diseased seed were checked in growth and never attained the vigour and feeding value they should have. The bulk of the sorghum land in New South Wales was now affected with the disease. The only remedy was the selection of resistant varieties, and if healthy plants were found in a badly-infested patch the seed of those healthy plants should be carefully kept, and by continuous selection on those lines a useful and resistant strain should result. Saccaline and some of the Department's selections from Planter's Friend were most resistant at present to red stain.

Proceeding to deal with other plant diseases, Mr. Hamblin remarked that head smut affected both sorghum and maize, and neither should follow the other on land liable to produce smutted crops.

An example of leaf stripe was to be seen on Mr. James' farm, Amber Cane and Saccaline being side by side, the first badly affected with leaf stripe, and the second quite green. This was new land, formerly an old cattle camp.

Mr. J. Stevenson asked if the spores of red stain would still be capable of germination after passing through animals, but was informed that this was still doubtful, though it was not very important, as the disease was air-borne.

Mr. L. McPhail stated that a crop of his was badly diseased, while a crop grown by Mr. R. C. Johnson from the same seed was practically free. He also mentioned that a crop grown on new land was badly affected, while a crop on land continuously cultivated for thirty years was practically clean. The soils were different.

Mr. Gibson asked if late crops were less affected than early ones, and Mr. Hamblin answered that the temperatures might have something to do with such an apparent tendency. On the South Coast the late crops matured in the winter. On the North Coast broom millet was being very seriously affected by red stain.

In reply to a question why a plot where the timber had been burned off was badly infected, Mr. Hamblin said it was possibly due to an excess of potash or some other adverse condition in the soil.

The lecture was illustrated with lantern slides, specimens and photographs, and was evidently appreciated.

A very successful social evening was spent on 18th July, each member bringing a friend. About 100 people were present, and an enjoyable time was spent.

Freeman's Reach.

Mr. W. H. Spinks, Fruit Inspector, visited this branch on 15th July, and gave a lecture on citrus culture. The suitable districts, aspect, preparation and planting of the land, and the care of the trees while young and when in bearing were all dealt with. Several members took advantage of the opportunity to ask questions, and obtained valuable information in that way.

Garra-Pinecliff.

On 23rd June Mr. W. le Gay Brereton gave a grading and packing demonstration at Mr. S. W. Packham's, and in the course of it gave much useful information.

Glenfield.

Mr. P. McDonald read a paper at a meeting on 21st June, of which the following is a report:—

Improvement of Rural Social Conditions.

Mr. McDonald pointed out the influence of the school teacher in a district, and urged that parents should pull together with the school teacher. A visit to the school in the right spirit encouraged the teacher and pupils. Parents' support was also needed to obtain proper equipment, improved surroundings, and the like, for the school. The school grounds should resemble, as near as possible, a botanic garden, containing an agricultural as well as a horticultural section. The school building should be an attractive one, with plenty of light and ventilation. If the adjacent country contained many small towns and the roads were good, it would be advisable to build one large school, for fewer teachers would then be necessary than with a number of smaller schools, and the upkeep would be comparatively less. Such a school would need as part of its equipment a number of motor buses to convey the children to and from school. While school was in, these buses could be hired or used to convey fruit, eggs, butter, &c., for a co-operative society, which could be run in conjunction with the community school.

The education in a large school would be of a higher standard, and the combined efforts of teachers and pupils would show better results than the over-worked teacher of a one-man school. By building a large school, the basement or lower floor could be used as a community hall, available for pictures, school concerts, lectures, public meetings, and last but not least, public worship. The latter would not then be the problem it was to-day, as the community spirit would take hold of all denominations, making them more neighbourly and brotherly, seeing eye to eye with one another.

The chief problem confronting the farmer was to hold his children on the farm, and here again the community could assist by bringing the choicest of city amusements to the country. Another good move in the same direction would be the introduction of calf, pig, and poultry clubs, &c., the objects of which would be to try to interest the children in the rearing of farm animals and poultry. He suggested that a certain number of interested people should create a fund for the purchase of pure-bred stock, to be handed to boys desirous of rearing animals, together with directions for the care and handling of that class of animal. If this were done with pigs, for instance, one each could be handed to several boys, and on the expiration of, say, six months, the pigs be again brought together for the purpose of being judged, and a prize could be given to the owner of the best animal. The pigs would then be sold, the proceeds going towards refunding the purchase money and each lad receiving portion of the remainder, according to the price obtained for his pig. Or a heifer calf could be allotted to each boy, or perhaps girl, with the object of it being reared for competition. The calves could be sold, or perhaps a child could purchase his particular calf with the object of founding a herd. He or she would naturally have a greater desire for cattle rearing after being a prize winner in a competition. Similar methods could be used with regard to poultry.

Two prime needs in most country districts were (1) a co-operative marketing and purchasing organisation, and (2) a rural bank, to help the farmer (especially the small man) more thoroughly to utilise his opportunities, to enable him to obtain labour-saving appliances for the farm and home, and to enable him to brighten the home so as to make it look more home-like than many farm houses of to-day.

What Australia required was farmers' homes owned by folk who loved farm life for its own sake, who were intelligent and progressive, and who were earning enough off the farm to enable them to live with some of the comforts of life.

Mr. McDonald closed by suggesting moving pictures as a means of improving social conditions in the country. A community movie could be a community information parlour. There, weekly, could be learned health, sanitation, civics, world events, modern inventions, home and farm improvements, science, and household art. The

opportunities for instruction were very numerous indeed. Useful lessons could be set forth with it more graphically than could be done in any book. Public-owned picture outfits would bring interest and entertainment to once jaded folks, and save time, trouble, and expense in preparing local concerts.

Glenorie.

The annual meeting was held on 1st August, when the balance-sheet and report showed that the year had been one of progress. The following office-bearers were elected:—Chairman, Mr. F. A. Nicolson; Vice-chairmen, Messrs. H. Walker and E. King; Hon. Secretary, Mr. G. W. Hitchcock.

Arrangements were made for the staging of an exhibit of fruit at the Royal Society's rooms in Sydney in connection with the Sydney (Metropolitan) branch, after which the fruit should be sent, at the growers' wishes, to the hospitals. The Glenorie growers were very proud of this display, and themselves hired two motor-lorries to take it to the city.

Hannamvale (*viâ* John's River).

This branch held a meeting on 15th June, when Mr. C. C. Crane, Organising Inspector, was present and delivered an instructive lecture on co-operation.

Kentucky.

A branch has been formed at this centre, particularly in connection with the Returned Soldiers' Settlement. At a meeting held at Mr. Fulthorpe's house on 20th July, it was agreed to hold meetings monthly in the school-room. It was agreed to ask that a veterinary officer visit the settlement as soon as possible, and that application be made for visits by other Departmental officers.

Kunama (Batlow).

At a meeting on 19th May, a lecture was given by Mr. R. J. Scifleet, Manager of the Settlement, his subject being methods of pruning and care of fruit trees. The information conveyed on many points was practical and valuable.

On 20th July, Mr. S. A. Hogg, Assistant Fruit Expert, attended this branch and gave an address on fruit-growing that was appreciated. The same evening Mr. C. C. Crane, Organising Inspector, was present and gave a lecture on co-operation. He was pleased to find that the branch had a co-operative of its own.

Lower Portland.

The annual meeting of this branch was held on 4th August, when the office-bearers elected were:—Chairman, Mr. Bruce King; Vice-chairman, Mr. J. Blundell; Treasurer, Mr. R. J. Metherell; Hon. Secretary, Mr. H. Hayward.

The treasurer's statement showed that the income had been £190 3s. 6d., and the credit balance in hand was £9 3s. 1d. Included in the disbursements were the sums of £80 13s. 9d. to Windsor District Hospital (the result of a special effort), and £44 as prize money for the show (as compared with £23 19s. for the previous show). The membership remained very satisfactory.

Malebo.

A lantern lecture was given by Mr. Pedersen, Dairy Instructor, on dairying subjects on 20th July, and drew a good gathering.

March.

Mr. N. Griffith read the following paper at a meeting on 18th May.—

Co-operation.

It is a recognised fact that co-operation must arise from necessity if a successful association is to be formed. It is also essential that members should be well acquainted with each other, and that they should be interested in the purchase and distribution of similar products. Much organised work is necessary to prepare the way for co-operation in this district, but the rural workers' claims and the organisation of other trades and occupations is making it necessary. All along the line the primary producers seem to be up against some organisation or other. The domination of capital in the past, and the unreasonableness of organised labour in the present are two extremes, and must result in revolution if continued.

Loyalty is the keynote of success in co-operation. In a certain town one of the leading tradesmen remarked that it would be £1,000 well spent to crush a small co-operative society that had started there—and it was crushed, the members of the society eventually paying the £1,000 to crush their own business.

It is advisable that co-operative purchasing should come prior to co-operation in the marketing of products. In co-operation each member is responsible for the success or failure of the movement, and each member should realise the responsibility of his part. Primary producers often shirk this responsibility; they take no interest in the movement, are willing to let their neighbours shoulder all their responsibility, sell and buy wherever they can, and only patronise the co-operative association when they cannot procure to better advantage elsewhere.

Most producers seem afraid to put down a £5 or £10 to form an association, as they think there is a chance of losing their money. They seem to prefer a straight-out loss on the purchase of some piece of machinery.

I would advise the formation of a co-operative society on a pecuniary profit system, as members would be more likely to support it when there is some visible return for their expenditure, and it would tend to increase the membership when non-members learn of the dividends received by neighbours. It is my opinion that the Government should assist producers' co-operative societies in the way of finance, legal advice, grants of land to build store-rooms, silos, &c.

Here are a few instances why it is necessary to form a co-operative society here. Local producers were getting 1s. 9d. per lb. for butter when the same butter, bought over the counter, was costing 2s. 8d. per lb. Hides have come down in price, but boots have not. Prime mutton can be bought at the yards to-day at 3½d. per lb., but it costs 9d. over the counter. Wheat has fallen in price, but bread has not. The same applies to wool and clothing. On numerous occasions the orchardist has received considerably below the cost of production for his fruit.

I will briefly quote a few of the things that could be done here by co-operation. The purchasing of fruit-cases could be done more economically than at present, and also the purchasing of wrapping and lining paper by indenting our own. In a recent publication of the *Agricultural Gazette* it was stated that a co-operative sheep-dip had been run successfully; why should not the graziers of this district organise and do likewise at a big saving? I also favour the Women's Institute co-operative movement. As a side-line a co-operative society could deal with pests, such as parrots, rabbits, hares, &c., to good advantage, and the codlin moth could, no doubt, be reduced, if not eliminated, by a co-operative campaign against it. The formation of a packing shed, evaporator, and pulping plant is a most necessary thing to this district. The orchardist could then leave grading, packing, evaporating, pulping, and marketing in the hands of persons more competent to deal with them than himself, and could concentrate his attention on growing the fruit. The co-operative packing-shed would do away with all the trouble of packing, stowing, cool storage, &c. Co-operative carting of fruit to the market or packing-sheds could be done to advantage.

In the event of the society adopting the packing-house scheme, it would be essential to have the subscriptions based on the productive acreage of the members, and the returns to be based on the actual sales effected. The expenses would have to be based on the quantity of fruit marketed, as a poor grade of fruit generally costs more to market than a good class, especially in the evaporating and pulping line. The orchardist spends money, time, and skill to get his fruit to the Sydney markets, then hands them

over to a system of exchange that is not satisfactory, as it is open to abuse. If the producer had a voice in the selling of his fruit, he would hold the key in his own hand, and if it could not be sold in the local markets at a fair price, it could be exported.

Co-operation would be a good investment for the poultrymen of this district. Each shareholder could have a small rubber stamp, numbered, and could stamp all his eggs with it and guarantee them fresh. All eggs could be gathered once a day; a carter could test all eggs for freshness, collect them at least twice per week, and consign them to market. In the event of a supplier putting in stale eggs, he should be liableto a fine.

The annual meeting of this branch was held on 20th July, when the balance-sheet showed a small credit after a useful year's operations. The office-bearers elected were :—Chairman, Mr. N. Griffith; Vice-chairmen, Messrs. J. Casey and H. S. Griffith; Hon. Secretary and Treasurer, Mr. R. Parker.

Matcham.

On 18th June papers were read by Mr. A. Macinante on manures and their uses, and by Mr. S. C. Aldridge on nitrification. A summary of the former is held over.

NITRIFICATION.

If we allow soil to remain sodden with water to the exclusion of air the nitrifying bacteria will diminish, and conditions will not be favourable for nitrification, so that we may here notice one reason for tilling the soil that we do not often think about. We must also consider the question of drainage, for the organisms require air to favour their work, and drains help greatly to aerate the soil. Also we must have an absence of sunlight, for the sun's rays kill the bacteria that convert the nitrogen in humus into nitric acid suitable for healthy plant life. Yet we must have a suitable heat for the bacteria to work in, as they cease to work before the temperature reaches freezing point. Again we must have a percentage of lime in the soil, for lime favours nitrification by killing bacteria that would prevent it, and also by assisting the process of oxidation of the humus, without which we cannot get suitable plant food.

Any of the leguminous plants such as peas, beans, lupins or clovers, are of great assistance in nitrification as they are able to absorb nitrogen from the atmosphere, and through the nodules that grow on their roots produce bacteria that assists greatly in nitrification. We grow peas around our citrus and other fruit-trees for the purpose of enriching the soil in nitrogen, and that is probably our cheapest way of obtaining nitrogen, though if we would obtain the highest results we should grow them in the summer instead of winter. Dried blood is one favourite way of applying nitrogen, but it has the disadvantage of not being quickly available, and I fear we apply a lot of dried blood to crops uselessly, owing to the blood having to decompose before the nitrogen can be assimilated by the plant.

Miranda.

At the annual meeting, on 11th July, the following were elected for the ensuing year :—Chairman, Mr. E. Thacker; Vice-chairmen, Mrs. Paton, Messrs. E. W. Phillips and R. M. Russell; Treasurer, Mr. J. W. Macfarlane; Librarian, Mr. W. J. Buckland; Hon. Secretary, Mr. A. Wigzell; Assistant Secretary, Mrs. R. M. Russell. The report showed that during the year several instructive lectures had been given, and the balance-sheet showed an excess of assets over liabilities of £83 8s. 3d. There were 125 members.

During the year a poultry competition has been held, eight competing for the trophy presented by Mr. Ley, M.L.A. First place was won by Mr. B. Stower, and second by Mr. Liebrand. Mr. J. England acted as judge.

A meeting was held on 25th July, when a number of pertinent questions from the question-box provoked interesting discussions. It was considered both possible and profitable to prevent Irish blight in a potato crop by spraying.

Moss Vale.

On 20th June, under the auspices of the Moss Vale branch, Mr. H. A. Mills, Fruit Inspector, gave a very interesting pruning demonstration.

Mr. Mills clearly showed the benefit to be derived from single leader pruning, by the breaking out of new wood and fruit spurs all along the limb of the tree so treated. This method is especially recommended in the case of old trees. This was the second demonstration at Moss Vale by Mr. Mills, and it is hoped that next year he will be able to come along and point to the results of the work done.

At night Mr. Mills gave a lecture, at which a large number of members were present. He showed the correct method of preparing the ground for setting out young trees, and explained how they should be pruned until the early fruiting stage. A fine sample of the latest apple of a very late and good-keeping variety called Tasman was shown. Names and descriptions of different diseases attacking fruit-trees were given, and grafting and spring budding explained.

Mr. Mills offered to give any one interested wood for budding, and any information, if they would write to him.

The branch is taking an interest in the proposed survey for a railway from the main southern railway to the South Coast.

Narooma.

A branch of the Bureau has been formed at this centre, with the following office-bearers:—Chairman, Mr. J. McMillan; Vice-chairman, Mr. W. T. Moorehead; Hon. Secretary and Treasurer, Mr. A. H. Costin. Membership has reached thirty-two.

The branch is seeking information with a view to the purchase of a stud bull for the benefit of members.

At a meeting in July, discussion took place on the most suitable maize for the district, nearly all favouring Hickory King, and it was agreed to inquire for 16 bushels of seed for distribution among members. Of potatoes the varieties most favoured were Beauty of Hebron, Up-to-date, Satisfaction, and Brownell's Beauty, and seed is also being inquired for of these varieties for the benefit of members.

Pambula.

The question of co-operative buying was freely discussed at a meeting on 21st June, and it was decided to hold an "order meeting" at an early date to take orders and send them, through the secretary, to the firms quoting cheapest.

It was decided to purchase a Jersey bull for use in members' herds, it being recognised that a good animal, sired by high producing parents, would benefit considerably the herds of the district.

Craig Mitchell, a variety of maize new to the district, was mentioned by two growers, and the superiority of Saccaline over other sorghums was also pointed out.

Rydal.

Mr. A. Lemon's paper, read at a meeting on 20th June, was as follows:—

Pasture Grasses suitable to the District.

Of our pastures on the whole, it may be said that they are poor, especially in winter. To overcome this it is necessary to resort to artificial grasses, and in doing so we want to select a grass or grasses which will resist severe frost. I give *Phalaris bulbosa* first place, as I consider it by far the best cold-climate grass. I have not given it a very extensive trial, but sufficient to prove that it is practically frost-resisting, and admirably suited to our district. *Phalaris* needs a fairly rich soil to come to perfection, and being

a deep rooter it is a good drought resister; in fact, on one experiment farm its roots have been known to extend to a depth of 6 feet. Drill sowing generally seems to be favoured on the experiment farms, the drills being about 2 feet 6 inches apart, so as to enable cultivation to be carried out; seeding at the rate of about 8 lb. to the acre. I have only sown broadcast, but this requires more seed. Sowing in autumn is best, as the young plants get a good root before the following summer. It is also a good plan to sow a light crop of, say, oats at the same time as the grass, as this affords a shelter for the young plants for the first winter. Only a light crop should be sown, however, as a heavy crop would take too much nourishment from the grass.

I give next place to cocksfoot, which I have found to thrive very well in our district and to be greatly relished by all stock, but it will not withstand severe frost as well as *Phalaris*; it does not require such rich soil as *Phalaris*, but seems to thrive on almost any poor land, and is a good drought resister. As it is a grass which is inclined to grow tussocky, it is considered a good plan to sow the seed thickly at the rate of about 40 lb. to 50 lb. to the acre, sowing in the autumn.

Perennial rye is another good grass, but does not seem to stand drought conditions as well as the two first mentioned. It seems to thrive on almost any of our reasonably good soils, but seems to prefer a clay loam. Sandy soils are not suited to it. It is considered best to sow it with a mixture of either clover or cocksfoot (20 lb. rye, 10 lb. clover), or 20 lb. rye with 10 lb. cocksfoot and 5 lb. clover.

It is not advisable to stock any of the grasses heavily for the first twelve months—only sufficient to keep them from running to seed.

DEPARTMENTAL NOTE.—The Agrostologist remarks that the grasses mentioned a e suitable for the district. *Phalaris bulbosa* could be sown through every drill, and on a properly prepared seed-bed cultivation is not required. We find that Bokhara clover grows well with *Phalaris* and also with cocksfoot. Sheep's Burnet is recommended for poor soils in cold districts. It can be mixed with the ordinary pasture mixture—cocksfoot, rye, and prairie. The Department is now developing a superior strain of the latter, which promises to be perennial in habit. The most important native winter grass for this district has been omitted by the lecturer, namely, *Danthonia semiannularis*, sometimes called wallaby, white top or fluffy top. This grass will grow on poor as well as good soils, and is highly recommended.

Sydney (Metropolitan).

A demonstration of the pruning of roses and other plants was given in the Botanic Gardens on 15th July, a number of the officers there acting as pruners and demonstrators. Mr. E. N. Ward, Superintendent, said the chief requirement in rose growing was to produce good healthy wood by cultivation; then, when it had flowered and was becoming weak and worn out, to cut it away and make room for new flowering wood, which burst from ripe and plump buds to be found on one-third of the wood of hybrid perpetuals, one-half of hybrid teas, and two-thirds of teas. In other words, for flowering purposes, hybrid perpetuals could be cut back to a third, hybrid teas to half, and tea roses to two-thirds.

The presence of the delegates to the Interstate Conference of fruit-growers was availed of by the Metropolitan branch for an informal but very interesting discussion on many matters connected with fruit-growing on 5th August. Mr. W. le Gay Brereton, Assistant Fruit Expert, gave some information on the various diagonal and numerical packs; Mr. J. Donaldson (South Australia) related the wonderful growth of co-operation among the fruit-growers of his State. Accounts were also given by other visitors of the development of co-operation and cool storage in their own States. Exhibits were staged by the Biological, Entomological, and Chemist's branches of the Department, showing the extent of their activities.

On 13th August a party of gentlemen representing grazing and dairying interests visited the Veterinary School of Sydney University, and was conducted by Professor Douglas Stewart through the laboratories and lecture rooms. A brief account of the teaching methods of the school was given. The operating theatre was found most completely equipped, and the chamber arranged for demonstrations to the students was much admired.

Tennyson-Kurrajong.

The following is the paper read by Mr. W. S. Arnold on 6th June :—

PASSION FRUIT.

There are quite a number of varieties of edible passion fruit, such as Mexican, Banana, Grenadilla, and others, but the one we here are most interested in is the common purple-fruited one known as *Passiflora edulis.* It is a native of Southern Brazil, and has fruit about the size of a hen egg. The Kurrajong district seems to be peculiarly adapted for the growth of passions, and they can be grown on any site or soil that we can grow our winter peas on, that being a large area. I have seen passions grow luxuriantly in sandy soils, loamy soils, and on heavy loams. The best site for the passions is undoubtedly the well-drained, sloping, north-east aspect, protected by a break-wind on the west and south. I have grown passions around a hill that faced all points of the compass, and learned a good many lessons therefrom in the training of the vine. Some trellis passions between their young fruit trees. The returns will more than pay for the upkeep of the young orchard when handled rightly. Personally I prefer to grow the vines by themselves, as I have seen both trees and vines checked by adverse weather conditions at a critical time.

Great care must be taken that the seed is from vines free from woodiness. At present many growers are obtaining their seed from Norfolk Island and Queensland, as woodiness is not very much in evidence in those fruits. However, fine results are obtained if one is careful in getting seed from vigorous, clean vines in his own district, and my experience warrants such selection. As only about 300 plants are required to the acre for planting, with vines 12 feet apart and in trellises of the same distance, twelve good specimens would provide ample plants for that area. Seed can be thinly sown in a warm, open seed-bed in autumn to be ready for spring. The hardier the plant the better, as when put out it must be kept growing from the very beginning. Although spring is the time for planting, commercially passions can be planted during any of the spring, summer, and autumn months if the weather is moist enough.

Land newly cleared, but from which one season's crop (preferably peas) has been grown, makes an ideal area, as the ground becomes sweet and in good condition, with a fair amount of organic and nitrogenous matter, &c., in it. Before planting, the trellises should be erected, the posts being 20 feet apart and 5 feet out of the ground and 2 feet in the ground. The end posts of the trellis must be substantially stayed and rammed in, as there is a very great weight to support when the vines are full grown. No. 8 wire is threaded through holes made about 2 inches from the top of the post on the same level and about 6 inches apart. Black wire is cheaper, and does not burn the young vines the first year, as is sometimes the case with galvanised wire. I recommend two wires on top. Trellises running north and south seem most favoured, as the sun can shine on both sides of the vine; especially is this needed for winter passions. The trellis at the western end should be made higher than the others to act as a break-wind. Sticks about 6 feet long are set in the ground along the trellis, about 12 feet apart and fastened securely to one of the top wires with tie wire; this is imperative. If the stake is not rigid the young vine often gets broken through the stake being displaced. A little blood and bone manure worked around the stake will help the young plant wonderfully when planted. Closest attention must now be given to clean cultivation. The young vine must be trained with a single stem till the wires are reached. All side shoots must be carefully removed, but not the leaves, or you will have a sun-scalded plant, which means a check (possibly resulting in woodiness). Once the trellis is reached the vines can be trained both ways until the wires are covered. Vines will now be flowering and the very best quality of fruit will be found up to eighteen months and will sell in any market any month.

Pruning is essential after the second year, as it produces the best paying crops and prolongs the commercial life of the plant. If left unpruned the plant practically exhausts itself in four years, whereas by judicious pruning and manuring vines can be kept profitable for six or eight years. On our red soils they last longer than the lighter ones. The summer crop coming in about February seldom pays, as the market is well stocked, so we prune in November to within 4 inches of the trellis to miss this market, and to induce a new growth that will produce an early and payable winter crop. Some orchardists leave pruning until January and February, and secure a late winter and an early spring crop, which is perhaps as profitable as the late winter crop. If one has a large area it is wise to work for both these markets. Pruning and manuring at the same time, especially if followed by a good rainfall, will cause a strong growth, which is almost a preventive from woodiness.

Whilst on the subject of woodiness I might state that it was the only disease I had to combat. It is a bacterial disease, found mostly in vines past their zenith of growth. It appears when the development had been checked by carelessly ploughing too near the vines (thereby destroying root fibre), by want of manure at the right time, exposure to bleak, cold winds, a heavy frost, or any other condition that checks the growth.

In a series of experiments the Department of Agriculture found the best results were derived by an application of 5½ cwt. sulphate of ammonia, 3 cwt. superphosphate, 1½ cwt. sulphate of potash to the acre, or at the rate of about 4 lb. of manure to each vine.

The best method is to prong-hoe 2 feet on either side of the trellis in winter and chip with flat hoe in the warmer months. Between these worked strips cultivate with a spring-tooth or disc harrow in preference to the plough. Vines are best manured in spring and autumn. It is always well to stir the land after every application of manure and after every fall of rain. Cultivation conserves the moisture, mellows the soil, and keeps the plants growing.

In the hot summer months the passion should be picked every day, or at least every other day, to get the best returns in Sydney. For Melbourne and New Zealand one can pull on the green side, but they must be well coloured for any market. Grading is absolutely essential, not only in size but in colour and quality, not putting any crinkly or woody ones with smooth, firm ones of the same size. On no account top the cases. One's brand becomes quickly known in the market, and buyers will purchase readily once they know the grades are uniform. The figures following are for fifteen half-bushels sent in one consignment, and demonstrate the value of grading, and this was when passions were fairly cheap—5 specials sold, 2 at 12s., 3 at 11s. 10d., 5 A1 at 10s.: 5, 1 sold at 4s. 9d., 3 at 4s. 8d., 1 at 4s. 3d. On fair land you can average about 230 cases per acre per annum. After all expenses are deducted one can clear £40.

The Mexican, from what I can make out, is a large-fruited purple passion. The Pomological Society decided it was of little commercial value in comparison with our locally-grown one. Palmdale Estate orchard, near Gosford, some time ago put 100 half-cases of these on the market and realised £100. Within three months the same passion could hardly be sold.

The banana passion grows luxuriously in the warm coastal districts. It fruits well—is somewhat of the colour, shape, and size of the small banana, but being soft skinned will not stand packing too well. An agent in the markets told me he has a keen demand for them. He sells them readily in punnets of 12 for 1s. 6d. to 2s., and the demand is growing.

The Grenadilla is a large passion, not at all suited for our purposes.

One local grower showed me his account sales for last July, August, and September from passions, and the cheque from the agent was £227. Only last March he realised 18s. to 23s. per half-bushel. His vines are planted 15 feet apart. Each vine pulled four half-cases.

Another grower told me he obtained 24s. for a half-bushel of 15 dozen fruit, and cleared over £50 an acre.

A third, from a block of 3½ acres of 7 year-old vines, took 853 half-cases, realising from 3s. to 32s. each. Manure was used with blood and bone. In 1916, three years previous, that same block cleared £300.

Last year from 5¾ acres a fourth received a return of £500. He used manure and blood and bone, 3 lb. to the plant, in the furrows, which makes the roots go down and does not feed summer grass. He only used one wire on top, planting 10 feet apart, in rows. His posts are 24 to 30 feet apart, and he struts them when a load sags them down. When six years old he grubs them out. He estimates that he made £50 an acre per annum for the period.

Passions ship readily to New Zealand, and realise 30 per cent. higher prices than Sydney markets. I sent two cases to England by a friend, just to see if they would carry. So far the English people have not acquired the taste, and hence the demand is small, and the same can be said of America. The Department sent twelve boxes to the Trade Commissioner at 'Frisco, in order to test the demand for this fruit and to determine the best method of packing. Three styles of packing were adopted—wax wrappers, ordinary wrappers and cork dust. The fruit arrived in good order. Those in wax and ordinary paper were excellent, but those in cork were riper and more shrivelled.

Thyra-Bunaloo.

On 16th June, Mr. A. Thompson read a paper dealing with ploughing in relation to depth of soil and subsoil.

Depth of Ploughing as Influenced by Depth of Soil and Subsoil.

The depth of ploughing depends largely on the kind of ground one is ploughing, for plain should not be ploughed as deep as timber land. Shallow ploughing is the easier to work, and in new ground for the first year it produces as good crops, if not better, than deeper ploughing; but if cropped two or three years in succession, it does not do as well as land that has been ploughed deeper.

When ploughed shallow, say 2½ inches, the land is easier to work and the crop will strike well; but it will not stand the hot winds of October and November as well as deep fallow. Again, it becomes dirty much more quickly and is subject to flag smut in the third year.

Deep ploughing, of course, is harder work, and takes more working to get it into a good seed-bed, and perhaps the crop will not be a very big yielder for the first year, but it will do well the second and third year in succession, and will not be nearly as subject to flag smut as shallow ploughing.

Plain land should be ploughed from 3 inches to 3½ inches deep, not worrying if a bit of subsoil is ploughed to the surface, as a little will not hurt, though too much is worse than shallow ploughing, because if much subsoil is brought to the surface the ground becomes sodden and sour, and if the land is ever left out to grass it grows only a stunted barley grass and not much of that.

Another reason for not bringing too much subsoil up is that once the top loam gets much subsoil worked into it, it will not soak up much water in a heavy rain, and therefore the water lies about in pools and kills everything that is sown on it. The depth plain should be ploughed, therefore, depends largely upon how near the surface the subsoil lies, and the ploughman should best be able to judge for himself the correct depth to plough. For timber ground, I think from 4 to 5 inches will be all right, and new land should be ploughed well the first time. Badly ploughed new ground is always bad to plough afterwards, because the poorly ploughed patches are always harder than the well ploughed ones. The best advice is, "When you fallow your land, plough it, not scratch the surface."

Discussion.—Many members advocated ploughing plains not too deep.

Mr. Adams was of opinion that many did not plough the plains deep enough. He mentioned some land adjoining him that had been ploughed well into the subsoil, and that neighbour had grown, and was still growing, the best crops in that part.

On the other hand, Mr. Mackintosh advocated shallow ploughing on plains. In support of this, he mentioned a neighbour's land that had been broken up to a depth of 8 inches or so, and spoilt, growing very little herbage since.

Mr. J. Sinclair favoured June fallow, and Mr. T. Tomlinson liked to have as much as possible turned over before the frosts.

Departmental Note.—The Chief Inspector of Agriculture remarks that while it has been possible to determine fairly accurately the depth and method of cultivation most suited to typical wheat soil, it has not yet been proved exactly what class of cultivation is most suited to the heavier types of soil. The black soils differ very much from the red soils, and further considerable differences exist between the types of black soil. Some are black and puggy, while others are loose and puffy. They vary, not only in different districts, but even on the same farm, and consequently much difference of opinion exists in regard to what class of cultivation should be given. The experience of the Department has been that it is not advisable to plough black soil more than 4 inches deep, but that it is important to plough thoroughly so that none of the ground is missed. Where the subsoil is close to the surface, care must be taken not to bring much up, and the depth must be regulated accordingly. Very often black soil becomes loose, and as such a condition is very detrimental to the growth of wheat, care must be taken to avoid having these soils loose when the seed is sown. It is found that the best practice is to plough thoroughly for fallowing and to prepare the soil for seeding by giving a shallow cultivation. If it is necessary to plough just before seeding the ploughing should only be shallow. In Victoria and South Australia the practice now largely adopted in dealing with this class of soil is to plough in March and to leave the land in a rough state through the winter.

Tilba.

A meeting was held on 13th July, when arrangements were advanced for a lecture on herd-testing by Mr. A. T. R. Brown, Dairy Instructor.

Toronto.

Mr. H. Filmer's paper, read at a meeting on 6th June, was as follows :—

Propagating Plants from Seed.

In raising seedlings a little forethought must be given, otherwise things may go wrong. One often hears, "I planted so-and-so, and did not get one up." The speakers do not say how they treated them. The common causes of seed failing to grow are planting in unsuitable soil, planting too deep, and planting in boxes that are allowed to get dry.

First we will deal with the position of the seed-bed. Different sorts of seed require different positions, meaning different amounts of shelter from the sun. The position required for hardy flower and vegetable seeds, such as snapdragon, phlox, stock, cabbage, lettuce, and onion, is one that is sheltered from all wind, but open to the sun. Do not select beds against fences, as they are too shady, and tend to make the plants too spindly and weak. Plenty of sunlight is what is required. We must see, too, that the drainage is good, otherwise, with excessive water, the ground will become sour, and thereby block the germination of the seed.

With the average garden soil, all that is required is plenty of well-rotted manure and the ground brought up to a fine tilth. If the ground is clayey, then some good sand is an advantage, and helps to stop the surface from becoming caked, which is one of the worst things that can happen to any seed-bed.

All seed should be planted in rows, not broadcast, as one can then be sure that the plants are going to get a fair amount of sunlight and will not be overcrowded. This is necessary to give short, stocky plants, not spindly ones, such as are often seen. The depth to cover seed goes by the size. Seed should be covered with fine manure or soil, equal to the thickness of the seed, fine seed not being covered at all, and large seed planted its own thickness in depth.

When planted, a good watering with a fine spray is needed so as to settle the earth around the seeds and start them off. Some shelter must be provided, a good plan being to stretch a piece of hessian over the bed; this tends to keep the earth more moist, and stops the sun from burning up the tiny young plants just as they appear above the earth. This protection can be left until they are up nicely, when it must be removed by degrees so as to harden them off gradually.

Seeds vary in the time they take to show through, from a few days to weeks. The bed should be kept moist, but not over wet. The after treatment of the plants varies according to how the seed was planted—if thickly, then they will have to be thinned out, and if thinly they will be all right, the idea being to give each plant enough room to grow.

Fine seed, such as coleus and cineraria, require different treatment from the hardier sorts, and are best planted under glass. The usual method is to get a shallow box or seed-pan, and two-thirds fill it with the best material possible; soak well with water before planting, then when it has drained well, dust the seed on the surface and place a piece of glass on the top. If it wants watering again before the young plants appear, stand the box or pan in some water and let it soak up; do not water from the top or the seed will be washed.

This branch met on 2nd August, when it was decided to compete in the District Bureau Competition at next Newcastle show. It was also agreed to be represented in the effort to arrange for a local co-operative movement.

Tregeagle, Chilcott's Grass, and Alphadale.

A meeting of this newly-formed branch (of which Mr. J. A. Haynes is the Hon. Secretary) was held on 7th July. After formal business had been transacted, a discussion took place on herd-testing. Mr. J. Buckley, in opening the subject, suggested that some means should be adopted of preventing the culls from tested-herds being placed on the market and bought

up by other farmers as guaranteed cows. Mr. Pryce said that while a dairyman might improve his herd to high yielding capacity, the introduction of a new bull into the herd would sometimes undo all that had been done, and reduce the herd to its previous level. Others took part in an interesting discussion.

Wallsend.

The monthly meeting was held on 18th July, when four offers to provide land for the erection of a hall for the branch were considered, and that of Mr. Lindsley accepted. It was decided to stage a display of produce at next Newcastle show in the competition for branches of the Bureau, for which a prize of £50 is offered.

Mr. Payne, of the Metropolitan Meat Industry Board, delivered a lecture at Cardiff to the amalgamated branches of Adamstown, Toronto, Warner's Bay, Cardiff, and Wallsend, on co-operation during the month, and the necessity of doing something to remedy the present deplorable marketing conditions was unanimously agreed upon. A committee was formed to draw up concrete proposals and submit to a later meeting.

The Forthcoming Fruit Crop.

A paper was read by Mr. P. Miller on this subject. To overcome gluts and allied contingencies, he urged that all branches of the Bureau in the district should organise immediately to find other avenues for the disposal of their products. In the present circumstances there was no incentive to plant more trees (although the public could, and would, consume up to six times as much fruit as was now grown), owing to the loss consequent on the system of distribution by middlemen.

Last season over £48,000 was lost to growers in peaches alone owing to this marketing system, and growers should take strong steps to combat this enormous loss.

The scheme now under consideration by the various branches contained suggestions, as follows:—

1. To conduct an associated-bureau store in Newcastle, employing their own graders, to secure to the public properly-graded fruit at an equitable price.
2. Unsold fruit to be made into fruit pulp or jam, the former for export and the latter for local consumption.
3. A factory to be established for the manufacture of lemon and orange squash.
4. Manufacture of candied peel.
5. One buyer in Sydney for the amalgamated branches of the Bureau.

To carry out this ambitious campaign it was necessary that at least 90 per cent. of growers should join the movement.

Warrah Creek.

A meeting was held on 14th July, when the site for a sheep dip was further discussed, the Pastures Protection Board having intimated willingness to grant a special lease of one acre for the purpose. The conditions were considered unsuitable, and members are seeking a freehold site.

It was agreed to apply to the Public Library for a box of books on agriculture.

Wellington.

On 15th July, Mr. W. H. Broadfoot, Fruit Inspector, conducted pruning demonstrations at the orchards of Mr. J. Edwards and Mr. M. McLeod, the attendances being good. Much interest was taken in the subject, and all appreciated Mr. Broadfoot's method of handling it.

Wentworthville.

A meeting was held on 6th July, when the monthly display of vegetables took place, some fine specimens being exhibited. The competition in several classes was keen.

A meeting of the Cumberland United Agricultural Bureau was held on 9th July, the following branches being represented:—Chatswood, Auburn, Wentworthville, and Blacktown. It was agreed that all branches in the county be invited to send one delegate for each fifty members to subsequent meetings.

A lantern lecture on insect pests was given by Mr. T. McCarthy, Assistant Entomologist, on 20th July. The value of good cultivation and the removal of all rubbish from and near the garden or orchard was indicated, and also the methods of control of sprays. The different phases of insect development from birth to maturity, and the time when most damage was done were both fully illustrated on the screen. After the enemy insects, the friendly insects were dealt with, and numerous questions were asked and answered before the meeting closed.

A fine collection of flowers was staged before the lecture in connection with the fortnightly competition.

Woonona.

The annual meeting was held on 12th July. The report and balance-sheet showed that good progress had been made in the year, the membership being 174, and the credit balance £66 2s. The show account was also £23 10s. in credit.

The report remarked that the branch was "out to educate, and if any man desired a farming life, then he could have many of his problems solved for him." Experiments in potato culture were being conducted on the local show grounds. The meetings had been well attended, co-operative buying is undertaken for members, and a school vegetable and flower show had been held during the year with great success.

The election of office-bearers resulted thus:—Chairman, Mr. E. Thomas; Vice-chairmen, Messrs. E. Cameron and N. H. Mann; Treasurer, Mr. G. Fowler; Librarian, Mr. E. Hope; Hon. Secretary, Mr. J. P. Fleming; Show Secretary, Mr. W. J. Polglase; Assistant, Mr. R. Hunter.

Yarramalong.

The monthly meeting was held on 15th July, when arrangements were made for a village exhibit at the next Wyong show.

Yarrandale.

A meeting was held on 26th July, when Mr. S. A. Hogg, Assistant Fruit Expert, gave a lecture and pruning demonstration at Mr. E. S. Twiggs' orchard.

Planting and Pruning.

The planting of trees was first dealt with. In digging the holes care must be taken to keep the top-soil and subsoil separate. Before planting all broken or damaged roots must be removed with a sharp knife. Should this be neglected the damaged portion died, and it was there that the white ant gained an entry, working its way up the roots to the stem of the tree. If at planting time care was taken to remove damaged roots and the orchard was kept well cultivated, white ants did little damage.

In planting, some of the subsoil with a little top-soil mixed with it was heaped, slightly cone-shaped, at the bottom of the hole, and on this the tree was set and the subsoil and top-soil were filled in, and the job finished up by pressing firmly around the tree with the foot Mr. Hogg favoured cutting back the newly-planted tree knee high, although it was not always done, some growers forming the trees from the strongest three branches.

In the pruning demonstration which followed the reasons for cutting out, shortening, or retaining were carefully explained. Asked why he had left the long leaders untouched on a certain tree that was otherwise apparently well pruned, Mr. Hogg said that experience had shown that the result of cutting back these leaders was a rush of sap, with three or four branches forming where there was one before. By leaving the leaders untouched the sap moved more slowly, and fruit was induced to form lower down on the tree. Once this condition was obtained the leaders could be cut back.

Yárrunga–Avoca.

The following is a report of Mr. E. Breakwell's lecture on 18th June :—

Lecture on Weeds and Grasses.

Mr. Breakwell remarked that, owing to unusually good seasons, weed growth had become a menace throughout the greater part of the State.

Unfortunately, in New South Wales, where generally speaking pastoral and farming areas were too large for intense cultivation, weeds had been allowed to obtain a strangle-hold. Practically every farmer realised the immense damage weeds could do, but much required to be done. For example, in laying down pastures the following facts should be taken into account, but often were not :—(*a*) Weed growth was usually more rapid than grass growth; (*b*) if the germination of the weed seeds was not encouraged by a couple or more cultivations before the grasses were sown, they would germinate when the grasses were sown, and as often as not would smother the grasses or seriously affect their growth.

The farmer should ask himself the following questions :—(1) What are my worst weeds? (2) Can I grow any smothering crop or in any other way eliminate the weed growth before laying down a pasture? A few hints were offered in answer to such questions.

In the Avoca district the worst winter and spring weeds were Cape weed, thistles, docks, and sorrel. In order to suppress such weed growth, grasses and clovers should be sown on a well-worked and previously cultivated seed-bed, or when the weeds had already made their appearance in the autumn months and had been removed as much as possible by cultivation, winter grasses or clovers could be sown. Bad summer and autumn weeds that germinated in midsummer should be suppressed by sowing the summer crops well before or immediately after midsummer when the weeds had been cultivated out. If weed growth was very bad, smothering crops, such as oats, field peas, or vetches were extremely useful for winter crops, but they should be sown as early as possible in the autumn in order to ensure a good growth by the time the weeds appeared.

Useful summer crops that smothered weeds were certain varieties of sorghum and maize, and possibly strong-growing pasture crops like Bokhara clover or kikuyu grass.

Specimens of the various weeds common to the district were shown and described. Sorrel was one of the most difficult weeds to eradicate if it became well established on well-drained and fertile soil. Advantage should be taken of any dry spell to expose the roots to the sun. Couch grass should be cultivated as much as possible in the winter, exposing the roots to the frost. To plough couch grass down in the summer was only to encourage its growth.

Reference was made to the harmful nature of marsh mallow, as proved by recent investigations carried out by the Stock Branch. Specimens of St. John's wort and Paterson's curse were shown. Any new weed appearing in the district should be submitted to the Department for identification, and if harmful, steps should be taken to eradicate it as soon as possible. More good could be done by shire councils concentrating their attention on one or two of the worst weeds of the district, and seeing that they were eradicated, than by dissipating their money and energy over a large number, and eventually effecting nothing. Some of the bad weeds of this and other districts would never be eradicated until much closer settlement and more intense cultivation were the rule. A strong public spirit was necessary in keeping down weed growth. A careless farmer should be made to feel that he was a menace to the community in allowing his weed seeds to blow far and wide. The Department was doing its share.

The excellent work on the weeds of New South Wales, just issued by Mr. Maiden, should be in the hands of farmers. The Department was keeping a close check on all imported seed, and seeing that no noxious weeds were introduced.

Special grasses and clovers were shown and described as being suitable to the district.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1921.

Society.	Secretary.	Date.
Cowra P., A., and H. Association	E. P. Todhunter	Sept. 13, 14
Ganmain A. and P. Association	A. R. Lhuede	,, 13, 14
Cootamundra A., P., H., and I. Association	C. H. Inson	,, 14, 15
Northern A. Association (Singleton)	J. T. McMahon	,, 15, 16, 17
Canowindra P., A., and H. Association	John T. Rue	,, 20, 21
Holbrook P., A., and H. Society	J. S. Stewart	,, 20, 21
Temora P., A., H., and I. Association	A. D. Ness	,, 20, 21, 22
Burrowa P., A., and H. Association	W. Burns	,, 22, 23
Henty P. and A. Society	H. Wehrman	,, 27, 28
Junee P., A., and I. Association	T. C. Humphreys	,, 27, 28
Murrumburrah P., A., and I. Association	W. Worner	,, 27, 28
West Wyalong and District P., A., H., and I. Assoc.	T. A. Smith	,, 27, 28, 29
Deniliquin P. and A. Society	P. Fagan	,, 28
Condobolin P., A., H., and I. Association	C. H. Leiferman	Oct. 4, 5
Hay P. and A. Association	C. L. Lincombe	,, 5, 6
Narrandera P. and A. Association	W. Canton	,, 18, 19
Hillston P. and A. Society	J. E. Peerers	,, 20
Millthorpe A. and P. Association	C. J. E. Hawken	,, 26
Tweed River A. Society	T. M. Kennedy	Nov. 16, 17
Lismore A. and I. Society	H. Pritchard	,, 23, 24

1922.

Society.	Secretary.	Date.
St. Ives A. and H. Association	A. K. Bowden	Jan. 13, 14
Albion Park A. and H. Association	H. R. Hobart	,, 20, 21
Kiama A. Society	G. A. Somerville	,, 25, 26
Wollongong A., H., and I. Association	W. J. Cochrane	Feb. 2, 3, 4
Inverell P. and A. Association	A. L. Varley	,, 7, 8, 9
Shoalhaven A. and H. Association	H. Rauch	,, 8, 9
Central Cumberland A. and H. Assoc. (Castle Hill)	H. A. Best	,, 10, 11
Southern New England P. and A. Association (Uralla)	H. W. Vincent	,, 14, 15, 16
Nepean District A., H., and I. Society (Penrith)	C. H. Fulton	,, 16, 17, 18
Dapto A. and H. Society	J. T. Geeson	,, 17, 18
Guyra P., A., and H. Association	P. N. Stevenson	,, 21, 22
Moruya A. and P. Society	H. P. Jeffery	,, 22, 23
Newcastle A., H., and I. Association	E. J. Dann	,, 22 to 25
Robertson A. and H. Society	E. S. Martin	,, 24, 25
Tenterfield A. Society	E. W. Whereat	Feb. 28 Mch. 1, 2
Tumut A. and P. Association	T. E. Wilkinson	March 1, 2
Oberon A., P., and H. Association	C. S. Chudleigh	,, 2, 3
Berrima District A., H., and I. Society	W. Holt	,, 2, 3, 4
Blacktown and District A. Society	J. M. McMurtrie	,, 3, 4
Glen Innes P. and A. Society	Geo. A. Priest	,, 7, 8, 9
Kangaroo Valley A. and H. Association	L. W. Vance	,, 8, 9
Campbelltown A. Society	J. T. Deane	,, 10, 11
Mudgee A., P., H., and I. Association	S. H. Somerville	,, 14, 15, 16
Armidale and New England P., A., and H. Assocn.	A. H. McArthur	,, 14 to 17
Cobargo A., P., and H. Society	T. McKennelly	,, 15, 16
Barraba P., A., and H. Association	C. E. Williams	,, 15, 16, 17
Luddenham A. and H. Association	L. W. Eaton	,, 17, 18
Tamworth P. and A. Association	F. G. Callaghan	,, 21, 22, 23
Hunter River A. and H. Association (Maitland)	E. H. Fountain	,, 22 to 25
Camden A., H., and I. Society	C. C. Irving	,, 23, 24, 25
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	April 5, 6
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 10 to 19
Clarence P. and A. Society (Grafton)	L. C. Lawson	May 3, 4, 5, 6

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Agricultural Gazette of New South Wales.

Pastures in our Wheat-growing Districts.*

THE DISPLACEMENT OF NATIVE GRASSES BY INTRODUCED HERBAGE.

E. BREAKWELL, B.A., B.Sc., Agrostologist.

THE type of vegetation prevailing in New South Wales wheat districts prior to settlement and before wheat-growing became at all general, and the type of vegetation now existing, is a subject of much importance and interest. especially in view of the considerable change that has taken place in the pastoral vegetation of these districts. The value of pastures consisting of introduced herbage as compared with those consisting of native grasses, and the methods by which the stock-carrying capacity may in any case be maintained at its maximum, are matters of the greatest economic significance to the State as a whole, as well as to pastoralists more particularly.

References to the condition, extent and variety of the pastures in the interior of New South Wales before settlement took place are particularly meagre. The most reliable evidence is obtainable either (*a*) from the records of early explorers, (*b*) from scientific contributions, or (*c*) from the statements of the early pioneers still living.

Allan Cunningham, in recording his journey from Bathurst to the Liverpool Plains in 1823, constantly refers to the "grassy hills and vales," and to the "open sheep downs and cattle valleys." He mentions the rich alluvial flats of the Cudgegong River, covered with strong grasses and native herbage, making a fine pasture for cattle. In reporting his journey over the Darling Downs, he mentions the luxuriance of the grasses and herbage growing in the month of June, and refers to the leaves of rib grass as 12 to 15 inches long.

In "The Picture of Australia" (author unknown), published in 1829, appears this very eloquent and descriptive passage:—"It is the soil chiefly that determines the native vegetation of Australia, and as that is continually varying with the form and the exposure of the surface, the native pastures come much nearer to landscape gardening than anything that is met with in almost any other country. There is a grove here, a lawn there, a shrubbery in another place, and in another still, a natural wall of the light-coloured stone appears at the opening of the foliage, as if it were part of the enclosure of a garden. . . . On the elevated country to the north-east of Bathurst, and that for a very considerable extent, a stranger would find some difficulty in persuading himself that he were in a country, not only which the hand of man had not touched to improve it, but where there was not one fixed, and hardly even a wandering inhabitant."

* Paper read before the Agricultural Section of the Australasian Association for the Advancement of Science, Hobart, 1921.

Probably no explorer was more painstaking in his botanical observations than Sir Thomas Mitchell. Not only does he give us a general description of the flora, but, in most cases, specifies the most striking or important plants. We learn from his reports that there existed in his day, on the plains of the Bogan and Macquarie Rivers, large areas of *Panicum flavidum*, *Danthonia* species and *Solanum esuriale*. On the banks of the Lachlan there grew in great abundance large bushes of *Atriplex* (saltbush), *Mesembryanthemum* and *Trigonella suavissima*. He mentions that the *Mesembryanthemum æquilaterale* grew almost everywhere on the plains between the Lachlan

Fig. 1.—Association of Marsh Mallow, Barley Grass, and Burr Trefoil in the North-western Districts of New South Wales

and the Murrumbidgee, and seemed to take the place of grass. *Atriplex halimoides* (saltbush) also grew well on the rising ground near the Murrumbidgee River He also refers to the fine plains of *Anthistiria* (Kangaroo grass), and states that it is the same grass which grows on the most fertile parts of the counties of Argyle and Murray, and is, he believes, the best Australian grass for cattle.

It is clear from the foregoing that a century ago the areas of native grasses and other native fodder plants in the present wheat-growing districts were somewhat considerable in extent. The sheep downs referred to by Allan Cunningham probably consisted of the Danthonia, Stipa and Chloris grasses, as many of them do at present, while the large cattle grasses of the plains and

valleys refer to such genera as the Panics, the Andropogons, and Anthistirias. Kangaroo grass, now confined for the most part to railway or enclosed areas, appears to have been particularly common. It is also interesting to note Sir Thomas Mitchell's reference to the abundance of the saltbushes. With the exception of Rhagodias growing in sheltered situations, these fine fodder plants have practically disappeared in the wheat-growing districts. According to scientific contributions the grasses in the accompanying table were much more abundant in the past in the wheat-growing districts. In some cases they have altogether disappeared, or have become confined to small protected areas, while others have been most persistent and are still very plentiful.

TABLE showing Probable Previous Habitat of Different Grasses and their Habitat To-day.

Grass.	Probable Previous Habitat.	Present Habitat.
Andropogon sericeus (Queensland Blue grass).	Right throughout the interior; less abundant in the Riverina.	Still abundant on the North-western Slopes; very rare on the Central Slopes and Riverina.
Andropogon bombycinus (Satin Top grass).	Coast, Liverpool Plains, Central Slopes, and Riverina.	Very rare anywhere; found in protected areas on the North-western Slopes.
Andropogon intermedius (Rare Blue grass).	Common in cold localities, such as New England, Mudgee, &c.	Still fairly common in New England, but rare elsewhere.
Themeda (Anthistiria) avenacea (Tall Oat or Wild Oat grass).	Abundant on good plain soils throughout the interior.	Now found only on the North-western slopes, and here it is fairly rare.
Themeda Forskallii (Kangaroo grass).	Different varieties common everywhere.	Still fairly common in pastoral country, such as New England, South-western Slopes, &c., but in the more closely settled wheat-growing districts it has practically disappeared, and is only found occasionally in protected areas, particularly in railway enclosures.
Iseilema (Anthistiria) membranacea (Flinders grass).	Fairly common on the North-western and Central-western Slopes.	Only in the North-western Slopes, where it is fairly rare; has disappeared altogether from the Central Slopes.
Astrebla species (Mitchell grass).	Common on the North-western Slopes; less abundant elsewhere in the interior.	Rare on the North-western Slopes; has disappeared elsewhere.
Eriochloa punctata (Early Spring grass).	Very common on plain or low-lying soils throughout the State.	Still fairly common on the North-western Slopes and around bore drains of the West, or irrigation channels at Leeton; has practically disappeared from the closely-settled wheat-growing areas of the West.

TABLE showing Probable Previous Habitat of Different Grasses—*continued.*

Grass.	Probable Previous Habitat.	Present Habitat.
Panicum flavidum *P. decompositum* *P. gracile* ... *P. effusum* ... *P. divaricatissimum* *P. prolutum* ...	All these species have been very common in the past in the areas devoted now to wheat-growing, often monopolising the situation on the flat country.	Only occasional plants can now be found in wheat-growing districts, whereas in the pastoral country, such as on the Central-western Plains, they are fairly common. *P. divaricatissimum* (Umbrella grass) and *P. effusum* appear to be persisting the longest in wheat-growing districts.
Erianthus (*Pollinia*) *fulvus* (Brown Top or Sugar grass).	Common in the North, North-western and Central-western districts.	Still common in the North and North-west, where cultivation is not as excessive as and more recent than elsewhere. It is rare or altogether absent on the Central Slopes and Riverina.
Neurachne Mitchelliana (Mulga grass).	Found in fair quantity throughout the present wheat-growing districts.	Only found occasionally on the North-western and Central Slopes; has entirely disappeared from the Riverina.
Danthonia species (Wallaby or White Top grasses).	Very abundant right throughout the State.	Still common and apparently the most persistent of our native grasses. Only comes again slowly, however, on cultivated land.
Chloris truncata (Star or Windmill grass).	Abundant throughout the State.	Still very common everywhere, but not persisting as well as Danthonia species.
Chloris acicularis (a Star grass).	Abundant, but less abundant than *C. truncata*, throughout the State.	Although found occasionally everywhere, there is distinct evidence that it is disappearing on cultivated areas.
Chloris ventricosa (Tall Star grass).	Probably abundant on scrub lands.	Now practically absent in wheat-growing districts.
Stipa species (Corkscrew or Spear grasses).	See remark on Danthonias.	The Danthonias and many of the Stipa species, principally *S. setacea* and *S. scabra*, are closely associated. *Stipa aristiglumis* is still fairly common on the black soils of the North-west.
Aristida species (Wire grasses).	Only one species viz., *A. Behriana*, is a good fodder grass in wheat-growing districts. This was originally plentiful on the Central Slopes and Riverina.	Now confined to the Riverina, where it is becoming less common than formerly.

The Introduction of Foreign Plants.

During the last fifty years a great change has come over the pastures in the wheat-growing districts. On the loose alluvial or basaltic soils the native grasses have practically all disappeared, and their places have been taken mostly by short-lived spring annuals. When, on the approach of hot summer conditions, these annuals die, the soil is left singularly bare of vegetation.

The introduced plants which have gained a strong hold in the interior, and which provide, in most localities, the greater portion of the sheep feed, are commonly known by the pastoralist as "herbage." Such herbage may comprise many of the botanical orders, not excluding grasses. The following list gives the principal plants generally known under this heading, and for the purpose of convenience it has been thought advisable to couple the common name with the botanical, and thereafter in this paper to use the common name only wherever possible :—

Leguminosæ.

Trifolium glomeratum (Ball clover).
tomentosum (Woolly clover).
arvense (Hare's Foot trefoil).
procumbens (Hop clover).
Medicago denticulata (Burr trefoil).
minima (Woolly trefoil).
maculata (Spotted trefoil).
laciniata (A burr trefoil).

Geraniaceæ.

Erodium cygnorum (Native crowfoot).
cicutarium (Alferilla, introduced crowfoot.
moschatum (Musky crowfoot, introduced).
Geranium dissectum (Wild geranium).

Cruciferæ.

Capsella bursa-pastoris (Shepherd's purse).
Lepidium ruderale (Pepper weed).
Sisymbrium orientale (Mustard weed).
officinale (Mustard weed).

Compositæ.

Cryptostemma calendulacea (Cape weed).
Carduus marianus (Milk or variegated thistle).
Centaurea melitensis (Cockspur or Saucy Jack).
Helipterum floribundum (Native daisy).

Malvaceæ.

Malva parviflora (Marsh mallow).

Plantagineæ.

Plantago lanceolata (Rib grass).
varia (Rib grass).
major (Rib grass).

Cucurbitaceæ.

Cucumis myriocarpus (Wild melon).

Labiatæ.

Salvia verbenacea (Wild sage).

Polygonaceæ.

Rumex acetosella (Sorrel).
Polygonum aviculare (Wire weed, Hog weed or Knot weed).

Gramineæ.

Hordeum murinum (Barley grass).
Festuca bromoides (Rat's Tail Fescue).
Lamarckia aurea (No common name).
Phalaris minor (Wild canary grass).
Bromus maximus (Great brome grass).
tectorum var *longipilus* (A brome grass).
Bromus mollis (Soft brome grass).
sterilis (Sterile brome grass).
Eragrostis major (Stink grass).
sp. (Introduced love grasses).

There are many other introduced plants found in pastures, but the foregoing list comprises the greater part of the vegetation and fully 95 per cent. of the introduced plants in the situations referred to, that is, on alluvial or basaltic soils.

Influence of Temperature and Rainfall.

Investigations which I have now conducted for a considerable period have undoubtedly proved that soil is not the only factor determining the class of herbage, but that the temperature also plays a considerable part. One might imagine that, since practically all the introduced plants come from European countries with cold winter and spring climates, there would be no part of New South Wales too cold for such plants. The trefoils, however, are not at all common in the western division from Bathurst to Molong, or in the southern division from Goulburn to Harden, or in the colder portions of the South-western Slopes. For example, one sees a decided change if

one compares the vegetation in the cold district of Orange, where grasses predominate, with the vegetation in the warm district of Wellington, 60 miles away, where trefoil, crowfoot, &c., are mostly in evidence.

Generally speaking, the winter and spring rainfall in the wheat-growing districts is ample for the best growth of herbage, and this cannot be considered a factor in determining the type of plant.

An œcological analysis of the herbage found in various parts of the State will be given further on. Meantime, it will be seen on reference to the table of temperatures hereunder that temperature is responsible for a considerable

Fig. 2.—Crowfoot country in the Condobolin District.

variation. All the towns mentioned are in the wheat-growing districts, but unfortunately, I have neither temperature nor rainfall data for the north-western towns, Narrabri and Curlewis, where the months of September and October are warmer than in the towns listed. The long winters, as contrasted with the warm springs, are decisive factors in the types and growth of the different herbage.

TABLE showing Temperatures and Rainfall over the period May to October in different parts of the Wheat-growing Districts of New South Wales.

Town.	Temperature and Rainfall.	May.	June.	July.	August.	Sept.	Oct.
Orange	Mean max. temp., deg. Fah.	57·6	50·3	48·9	52·2	58·2	66·2
	Mean min. temp., ,,	38·0	36·0	35·6	35·2	37·9	41·1
	Mean temperature ,,	47·8	43·2	42·2	43·7	48·0	53·6
	Absolute min. temp., ,,	25·5	20·7	20·5	21·7	23·7	28·0
	Average points, rainfall	292	431	319	346	297	305
Forbes	Mean max. temp., deg. Fah.	66·1	58·8	57·3	62·1	69·0	76·7
	Mean min. temp., ,,	44·2	40·9	38·6	40·4	44·3	49·9
	Mean temperature ,,	55·2	49·8	48·0	51·2	56·6	63·3
	Absolute min. temp., ,,	28·8	27·0	23·0	24·0	31·0	32·0
	Average points, rainfall	167	183	154	174	173	176

Table showing Temperatures and Rainfall over the period May to October over Wheat-growing Districts in New South Wales—*continued.*

Town.	Temperature and Rainfall.	May.	June.	July.	August.	Sept.	Oct.
Dubbo ...	Mean max. temp., deg. Fah....	68·2	60·9	59·7	64·1	70·6	78·9
	Mean min. temp., ,, ...	42·3	38·6	35·5	37·1	42·0	48·2
	Mean temperature ,, ...	55·2	49·8	47·6	50·6	56·3	63·6
	Absolute min. temp., ,, ...	23·4	19·9	16·9	17·9	20·9	27·9
	Average points, rainfall ...	188	194	161	180	174	162
Cowra ...	Mean max. temp., deg. Fah....	64·9	57·6	56·0	60·0	66·3	75·5
	Mean min. temp., ,, ...	42·2	37·4	36·8	36·8	41·1	46·6
	Mean temperature ,, ...	5[illegible]	47·5	46·4	48·4	53·7	61·0
	Absolute min. temp., ,, ...	27·0	24·0	24·1	21·0	26·1	28·0
	Average points, rainfall ...	163	239	194	201	201	207
Young ...	Mean max. temp., deg. Fah....	62·6	55·4	54·1	58·5	65·4	72·6
	Mean min. temp., ,, ...	39·8	35·8	35·3	36·5	39·6	44·1
	Mean temperature ,, ...	51·2	45·6	44·7	47·5	52·5	58·4
	Absolute min. temp., ,, ...	26·9	21·9	21·9	22·9	21·9	29·9
	Average points, rainfall ...	203	295	230	231	224	225
Gilgandra ...	No temperature data available.	...	...	...	...	...	...
	Average points, rainfall ...	188	206	177	191	146	164
Harden ...	No temperature data available.	...	...	...	...	...	...
	Average points, rainfall ...	168	267	225	211	204	201
Wagga ...	Mean max. temp., deg. Fah....	64·6	57·3	56·6	60·8	67·1	74·6
	Mean min. temp., ,, ...	42·0	39·2	38·4	39·4	43·5	47·2
	Mean temperature ,, ...	53·3	48·2	47·5	50·1	55·3	60·9
	Absolute min. temp., ,, ...	22·0	22·0	26·0	26·0	26·0	31·0
	Average points, rainfall ...	187	264	182	195	187	207
Urana ...	Mean max. temp., deg. Fah....	66·9	59·6	58·3	61·7	70·7	76·9
	Mean min. temp., ,, ...	43·9	38·0	37·5	39·7	44·2	49·4
	Mean temperature ,, ...	55·4	48·8	47·9	50·7	57·4	63·2
	Absolute min. temp., ,, ...	28·0	28·0	28·0	28·0	33·0	34·0
	Average points, rainfall ...	186	219	136	151	147	143
Narrandera...	Mean max. temp., deg. Fah....	69·2	61·0	59·5	64·0	69·7	77.2
	Mean min. temp., ,, ...	40·4	37·6	36·8	38·2	43·2	48·0
	Mean temperature ,, ...	54·8	49·3	48·2	51·1	56·4	62·6
	Absolute min. temp., ,, ...	27·5	21·0	24·5	28·0	26·0	28·0
	Average points, rainfall ...	156	202	136	155	142	163
Bathurst ...	Mean max. temp., deg. Fah....	62·6	55·3	51·0	58·2	64·6	72·2
	Mean min. temp., ,, ...	36·0	33·9	31·7	32·7	37·3	42·2
	Mean temperature ,, ...	49·3	44·6	42·8	45·4	51·0	57·2
	Absolute min. temp., ,, ...	20·0	15·7	13·0	18·7	21·0	25·0
	Average points, rainfall ...	177	196	164	172	179	220
Glen Innes ...	Mean max. temp., deg. Fah....	61·1	55·2	53·5	56·6	64·5	70·8
	Mean min. temp., ,, ...	38·5	34·6	31·6	33·5	38·3	43·6
	Mean temperature ,, ...	49·8	44·9	42·6	45·0	51·4	57·2
	Absolute min. temp., ,, ...	19·0	19·0	16·0	16·0	25·4	24·0
	Average points, rainfall ...	168	228	171	197	195	289
Inverell ...	Mean max. temp., deg. Fah....	67·4	61·1	59·2	62·7	69·9	75·9
	Mean min. temp., ,, ...	38·2	34·6	31·5	33·5	37·9	44·2
	Mean temperature ,, ...	52·8	47·8	45·4	48·1	53·9	60·0
	Absolute min. temp., ,, ...	22·5	15·5	14·0	20·0	23·0	21·7
	Average points, rainfall ...	197	218	188	195	204	254

Before showing the relationship between the temperatures and the types of herbage, we may discuss briefly the plants found in the various districts.

(*To be continued.*)

Experiments in Cold Storage of Potatoes.

Experiments carried out by the Department in the cold storage of potatoes have not so far been attended with marked success. In 1913, 3½ tons were held in storage for three months, the chamber being kept at a temperature ranging from 34 to 37 degrees Fah. The potatoes were apparently in good order when removed from storage, but almost immediately afterwards commenced to go bad, many of them developing black patches within the tubers. In 1914 a test was conducted in the laboratory, the temperature in this case being maintained at between 40 and 50 degrees Fah. by the use of ice. The potatoes were again apparently in good condition on completion of the test, but they again quickly deteriorated.

The change of temperature from cold storage to outside summer conditions is apparently so great as to cause a sudden collapse of the plant cells. The percentage loss on the whole consignment in the first experiment, due to shrinkage, was 5·47 per cent., the least loss being that on the variety Satisfaction, and the greatest on Early Rose. The white-skinned varieties, Up-to-date and Carman No. 1, succumbed more quickly than other sorts after removal from storage.—A. J. Pinn, Inspector of Agriculture.

A Serviceable Hillside Silo.

"I wish to build a couple of silage pits in a steep hillside, by excavating and using the earth for the back and part of two sides, making the front of concrete or brick," wrote a correspondent recently. Could the Department supply him with pamphlets and advice?

A supply of the Department's free literature on the subject of silos and silage was supplemented by the following note by the Chief Inspector of Agriculture :-

"A good hill silo could be made by excavating the earth and using this to increase the depth by placing it around the sides and one end, and such a silo will be serviceable provided there is no underground seepage and surface waters are prevented from flooding into the silage. It is thought that a concrete front wall would not be suitable, but a good wall could be made by using timber. A silo of this type, in which the timber of the front wall consisted of old railway sleepers (kept in position by hardwood uprights) was used at Bathurst Experiment Farm, and although, owing to the granitic formation of the country, the walls ultimately collapsed, it was found serviceable for some time. It is usually only in granite country that any trouble is encountered. Where the soil stands well such a silo should be very satisfactory."

A correspondent who desired to know what proportion of meat in conjunction with pollard or other grain foods should be fed to pigs, and whether weaners should be fed on meat, was informed by the Principal of Hawkesbury Agricultural College as follows :—"The Piggery Instructor does not recommend feeding meat in any large quantities to pigs, either young or old. In our feeding at the College, 5 per cent. of meat-meal is used, mixed with pollard, grains, and skim milk."

Increased Production in the West.

J. T. PRIDHAM, Plant Breeder.

WHEAT testing has been carried on at Nyngan Experiment Farm since 1911, and the ten years' work has given us valuable information as to the best varieties for such dry areas, even though wheat-growing has not been materially extended to those conditions.

The yields for 1911 to 1914 were not ascertained, as a good deal of preliminary testing had to be done before the class of plant suitable to the local conditions was arrived at. The ideal plant seems to be one which stools sparingly and grows rapidly, making the most of the stored soil moisture before the hot winds of early summer check the growth. Both Mr. Kelly, the ex-manager, and Mr. Rudkin, who is now in charge, have demonstrated that payable crops of hay can be grown by careful cultivation, the yields of good years being stored as a stand-by for bad seasons. Grain production is too risky for this country, but fodder can be conserved as hay or silage, and an area for cultivation is a great asset for the man who has a sheep-run.

When the experiments were started a good number of wheats were tried, but year by year these were cut down, only the earliest maturing sorts being grown. Barley and oats have been sown during the last three years, and remarkable returns have been harvested from barley, which, however, is not so satisfactory for hay as wheat or oats, and if the grain is to be fed to stock it needs to be crushed or soaked. Cape and Trabut yield best on the average.

The results indicate that three varieties of wheat stand out from the rest—Clarendon, Gluyas, and Firbank. Canberra is also conspicuous, but Clarendon has somewhat better straw than either Canberra or Gluyas. The latter, which is a drought-resister well known to South Australian farmers, occurs in Clarendon's pedigree Bobs x Gluyas x Jonathan x Jonathan x Indian. King's White is of the same class as Gluyas, but the heads are bearded. Mulga and Sunrise have proved the best among the oats.

Six plots of each variety are sown in the tests, because the soil is patchy and a safer indication of the yield is afforded by repeated sowings at intervals and taking the average. The plots are 30 links long, about 45 plants in each plot. Sheaf and grain weights are noted to show the bulk of fodder as well as the grain, fodder being of prime importance.

The character of the seasons can be seen in the yields for each year, as well as in the rainfall records. For instance, there was a bumper harvest last season for such dry country, and in 1916 (another good year) the field crops gave a return of 2 tons 14 cwt. of hay per acre. On the other hand, the figures in years of drought are recorded in ounces instead of pounds.

For the first few years Firbank and Steinwedel wheat were mostly grown. Mr. Kelly had some fine crops of the latter wheat, which is very prolific and drought-resistant, but somewhat late in maturing at Nyngan as a rule. Firbank is at present the chief hay wheat grown there. Last year the oats lodged a good deal and consequently the grain did not fill; otherwise Mulga oats would have given a very good account of itself. Sunset wheat is the quickest growing variety we have, but the six years' trial show that it is possible to have a wheat too early even in dry country, and we now regard it as a variety for late sowing only, much in the same way as Bunyip and Canberra are regarded in the safe wheat belt. Indian varieties have been tried with fair results, but they are not equal to the sorts that have been evolved by cross-breeding and selection for the peculiar local conditions.

Although wheaten chaff is generally more relished by stock, oats contain a higher percentage of fat. Analysis shows that oats are the most nourishing of the cereals for sheep, and they are, besides, the most convenient and economical for the western grazier in times of scarcity. A galvanised iron tank with a sliding door at the bottom is a good investment for storing oats, that grain not being subject to sweating in the same way as wheat. If this can be made large enough to store oaten chaff, so much the better, but the small farmer would find it cheaper to make the oats into pit silage or else strip the crop, cut the straw and stack it, the grain being put into an iron tank. Of course, where a threshing plant is available the oats can be dealt with to greater advantage.

As Mr. Rudkin says, it looks as if we have now to perfect the system of cultural operations so that the maximum amount of soil moisture may be conserved for the crop. Surface grading and subsurface compacting may require more attention.

It may be said that in a good year every one has grass, and it could be made into silage for lean years. But is it practicable to send the binder into sheep paddocks to cut bush grass? Very few men have their land picked up so clean that a binder can work across a paddock without trouble. On the other hand, even if a good grain crop of wheat or oats is only secured every four years, by good fallowing enough fodder can be grown each year to supplement fully the supply stored in good years, either as hay or silage.

Our breeding experiments show that barley and wheat are the best drought resisters, but that the earliest varieties of oats are not far behind in yield. So that there is now quite a variety of feed within easy and profitable reach of the grazier and farmer in the western division, by which he may make himself largely independent of fodder supplies from the coast in times of drought.

Farmers' Experiment Plots.

MAIZE EXPERIMENTS, 1920-21.

Tamworth and Northern Tableland Districts.

MARK H. REYNOLDS, Inspector of Agriculture.

ALTHOUGH the elevation of the New England Tableland ranges from 3,000 to over 4,000 feet, its comparative nearness to the sub-tropical zone enables the successful growth and maturity of early varieties of maize.

For the season just concluded, of the five early varieties tested Golden Glow and Wellingrove (formerly Early Yellow Dent) have shown high comparative yields. As indicating soil and climatic conditions suitable to maize, the results at Tamworth are interesting. In the manurial trials, it was only on Mr. Chick's farm at Tenterfield that the expense for fertiliser was warranted.

The rainfall during growth at certain of the centres was as follows:—

	1920.			1921.			
	October.	Nov.	Dec.	January.	February.	March.	April.
	Points.	Points.	Points.	Points.	Points.	Points.	Points.
Tamworth ...	170	150	480	16	50	270	...
Tenterfield ...	..	206	270	112	290	285	149
Glen Innes ...	..	136	424	70	120	460	132

The crops grown on the land, the site of the various crops in the previous year, were as follows: Mr. J. F. Chick, Tenterfield, maize, millet, and cowpeas; Mr. H. Manser, Tenterfield, maize; Mr. J. F. Cowan, Tenterfield, maize, millet, and potatoes; Mr. O. J. Perry, Dumaresq, oats; Mr. W. W. Challis, Kentucky, pasture; Mr. W. Lye, Tamworth, lucerne; Mr. T. Farlow, Red Range, Glen Innes, potatoes.

RESULTS of Variety Trials.

	Nature of Soil.	Date Sown.	Superphosphate ℔ acre.	Varieties. Bushel Yields per Acre. Golden Glow.	Silver King.	Brewer's Yellow Dent.	U.S. 133.	Wellingrove.	Funk's Yellow Dent.	Craig Mitchell.	Silvermine.	Leggitt's Pride.	Golden Superb.
		1920.	lb.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.
Tenterfield ..	Uplands.	21 Oct.	70	25	23½	29	30	35	..	..	..	..	..
Dumaresq	,,	27 ,,	70	47	26	46	24	43	..	..	..	..	..
Kentucky	,,	4 Dec.	70	29	20	..	22	36½	..	..	..	..	..
Red Range ..	,,	27 Oct.	70	48	..	37	..	35	..	..	..	..	..
Tamworth ..	Alluvial.	1 ,,	Nil.	75	78¾	111	82	114	118	93	111	103	57

RESULTS of Manurial Trials.

	Variety.	No Manure.	Super. 70 lb.	M6 112 lb.	M8 126 lb.	M10 168 lb.	M10 84 lb.
		bus.	bus.	bus.	bus.	bus.	bus.
Tenterfield (Mr. Chick's) ...	Golden Glow ...	28	34½	35	32½	38	33½
Dumaresq..	Wellingrove....	51	43	51	62½	58	...
Tenterfield (Mr. Manser's)	Brewer's Yellow Dent.	33	32	36½	35	32	...

The cost (and composition) of the several manures used in the trials, exclusive of cost of mixing, freight, and application, was as follows :– Superphosphate, at 70 lb. per acre, 4s. 1d. per acre ; M6 (5 parts superphosphate and 3 parts chloride of potash) 112 lb. per acre, 16s. 6d. per acre ; M8 (5 parts superphosphate and 4 parts sulphate of ammonia) 126 lb. per acre, 14s. 4d. per acre ; M10 (5 parts superphosphate, 4 parts sulphate of ammonia, and 3 parts chloride of potash) 168 lb. per acre, 26s. 8d. per acre ; M10, 84 lb. per acre, 13s. 4d. per acre.

South Coast.

R. N. MAKIN, Inspector of Agriculture.

THE following farmers co-operated with the Department during the past maize-growing season in conducting experiments with different varieties of maize for their grain-yielding capacity :–

J. H. Martin, Pambula.
A. Louttit, Moruya.
C. T. Hindmarsh, "Alme Bank," Gerringong.
J. Chittick, Kangaroo Valley.
E. G. Kelly, Bega.

The season proved one of the best experienced for many years. Ample rain fell during December and January—months in which most varieties sown in October are tasselling. At Gerringong a very heavy fall was recorded for the month of December, viz., 23·38 inches, while Pambula (far down the coast) recorded 662 points for the same month. Wet conditions prevailed right up to June, making it difficult to keep the plots free from weed growth, and delaying harvesting operations.

Some very fine samples of grain were grown and some excellent records were obtained. All plots were sown with the maize-planter, except that at Pambula, which was sown on the check system by hand. A manure consisting of equal quantities of superphosphate and bonedust (P7. mixture) was sown at 2 cwt. per acre.

In all cases the ground was prepared by ploughing and harrowing several months ahead of planting, in order to have a good seed-bed for the crop, and

prior to planting the plot received another ploughing and harrowing. From 7 to 10 lb. of seed per acre was sown. At Bega and Moruya the plants made very tall stalk growth in some varieties (chiefly the late maturing ones), and many of the cobs were out of reach from the ground.

The Bega plot, from which very high yields were obtained, promised well from the start. It was certainly the best ground of all in the test, being typical good river flat, and still exhibiting the effects of a dressing of silt from a flood some few years ago. A previous experiment on the ground in the same paddock had shown the beneficial effects of artificial manure on maize crops, and Mr. Kelly is convinced that it pays well to apply manure, even though the soil will produce good crops without.

Altogether twenty-two varieties were under test, ten of which were sown on all plots, and four on one only. In some cases there was a good deal of variation in the yield of the same variety on different plots, whilst in others the yield was fairly constant. Funk's Yellow Dent, Golden Beauty, Leaming, Silvermine, Fitzroy, and Red Hogan all showed to advantage; they are now not at all new to South Coast conditions, and may be relied upon for good yields. What is required is farmers who will specialise in one or two of these varieties and carefully grow pure seed. There is already a strong demand for seed of these varieties every season at remunerative prices, and every year there is difficulty in obtaining sufficient seed of a reliable nature to meet the requirements of maize-growers.

Variety Trials with Maize.

Variety.	Pambula.		Moruya.		Gerringong.		Kangaroo Valley.		Bega	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
1. Golden Beauty	85	28	68	44	58	15	45	48	112	48
2. U.S. 133	67	28	34	22	63	40	38	9	58	42
3. Silver King	69	34	48	12	64	16	12	48	77	24
4. Funk's Yellow Dent ...	94	28	64	34	61	3	37	40	129	40
5. Silvermine	81	0	60	24	64	43	31	16	90	16
6. Leaming	84	12	70	4	68	40	65	4	82	48
7. Macleay Golden Superb ...	75	48	....		....		52	32	....	
8. American Golden Superb	63	0	....		....		48	32	....	
9. Craig Mitchell	89	2	....		60	20	15	24	128	16
10. Boone County	80	20	56	32	60	0	21	24	111	24
11. Giant White	80	20	....		56	32	21	30	101	24
12. Yellow Hogan	85	10	....		74	55	45	10	113	8
13. Yellow Mastodon ...	87	6	....		....		....		62	0
14. White Cap Horse Tooth ...	89	2	59	44	68	0	30	4	126	32
15. Red Hogan	98	20	73	52	70	6	46	40	122	0
16. Fitzroy	72	0	60	24	61	42	65	4	104	16
17. Yellow Moruya	....		68	8	....		....		125	40
18. Manning Pride	....		47	50	....		22	40	125	40
19. Golden Nugget	....		64	52	....		....		....	
20. Hickory King	....		50	44	....		....		....	
21. Eureka	....		49	28	....		....		....	
22. Goldmine	....		51	20	....		....		....	

The following notes were made respecting the plots:—

Bega.—Soil, alluvial; flat; sown on 14th October; harvested 21st June; rows, 4 feet apart; germination good; stem and leaf growth prolific; U.S. 133 and Silver King were the first to ripen; Red Hogan and Yellow Moruya last; Yellow Moruya stems were very fine for green feed or silage.

Pambula.—Soil, alluvial; flat; sown on 20th October; harvested, March, April, and May; U.S. 133 and Silver King were first to mature; Red Hogan, latest; sown on the check 3 ft. 6 in. apart; germination good; growth good; rainfall, October to end of April, 22·80 inches.

Gerringong.—Soil, alluvial; flat; sown on 14th October; harvested, June; drills 4 feet apart; germination good; all varieties were well up on 27th October; U.S. 133 tasselled early in December, Funk's Yellow Dent the fourth week in December; rainfall, 41·16 inches; U.S. 133 and Silver King earliest to mature, and Red Hogan latest.

Moruya.—Sown on 27th October; harvested in June; soil, granite formation; drills 4 feet apart; germination, good; many cobs of early maturing varieties were lost through wet weather; late maturing varieties stood the weather conditions best.

Kangaroo Valley.—Soil of sandstone formation; sown, 29th October; harvested in May and June; germination, good; drills 4 feet apart; good germination; crop suffered on account of not being workable during wet weather, when weed growth became abundant; the early varieties fared worst.

Increasing Yields by Bud Selection.

A GENERAL warning as to the importance of using proper methods when attempting to carry out in deciduous fruits what has already been accomplished with the citrus fruits was given last year by Mr. A. D. Shamel, the Californian experimenter. A paper by Mr. E. B. Babcock, of the University of California, now appears in the *Monthly Bulletin* of the Californian Department of Agriculture for April, emphasising the present "uncertainty as to what can be accomplished through performance records, and the propagation of selected high producers among the deciduous fruits," and mentioning workers in Missouri, Oregon, and Illinois, all of whom have had negative results with the apple. "While these experiments were of limited scope, only a few varieties being represented, and similar experiments with other varieties may give very different results, still it must be admitted that thus far experimentation has tended only to increase our doubt as to the practicability of increasing the yield of standard varieties of deciduous fruit through bud selection. . . . The regular practice of bud selection should be encouraged because it will assist in holding varieties true to type and it will increase the chances of discovering new and possibly valuable bud-sports. But the mere fact that bud-selection is practised is not sufficient to warrant any claims to special or unusual merit in nursery stock. The super-yielding tree of apple, peach, or plum, which will beget a super-yielding orchard has yet to be discovered."

Descriptions of New Varieties of Cereals.

J. T. PRIDHAM, Plant Breeder.

SOME of the following varieties have been grown for a considerable time on the Departmental farms under a number or a pedigree, but have now been given distinctive names for the sake of convenience. A short name is easier to remember than a pedigree, and a number conveys no particular impression to a farmer. The names no doubt mean adding to the number of sorts in cultivation, which is already large, but some of them may suit certain districts better than the varieties in favour there, and they are brought forward for trial only, no Departmental recommendation attaching to them. We would advise farmers to try only a small quantity, say a pound or less, of any new variety before buying larger quantities. If a grower cannot afford time for this amount of experimenting the results on the nearest farmers' experiment plots afford a guide.

Some New Wheats.

Forelock (until recently known as Wagga No. 46) is a selection from seed resulting from a supposed hybrid between Federation (mother) and a 2-row skinless barley. Although wide variations were found in the progeny, no barley characters were detected and it is possible that foreign pollen gained access to the ear at the time of hybridisation, though this we have not been able to prove for no other wheats likely to give rise to the differences since seen in the progeny had reached the flowering stage at the time the cross was made. The variety originated at Wagga in 1901. Forelock is a medium profuse stooler with awned ears, as its name suggests. The straw is of medium height and not inclined to lodge. It comes into ear at the same time as Yandilla King and Marshall's No. 3. The ear is white and erect, and the awns not coarse or long. The grain is white, of medium size, opaque and not inclined to shell. For a period of nine years in small plots at Wagga it has compared very favourably in yield with Marshall's No. 3. The flour appears to be in the medium strong class.

Riverina (recently known as Wagga No. 48) has the same origin as Forelock. It is a sparse stooler, heading about a week earlier than Hard Federation; the straw is of medium height and medium strength. It is a very fair wheat for early hay. The ear is white, somewhat tapering, medium erect, with a very slight tip awn. The grain is rather large, yellow, opaque and medium soft. The milling strength of the floor is about 46. It seems suitable for dry districts only.

Early Bird (formerly Wagga No. 50) has the same history as Forelock and is one of the earliest varieties we have, coming into ear only a week after Sunset. The stooling is sparse and the foliage rather scanty. The straw is of good height and somewhat inclined to lodge. The ear is white, tapering, rather erect, with a trace of tip-awn. The grain is of medium size, yellow, and does not shell. It is suitable for hay in very dry districts.

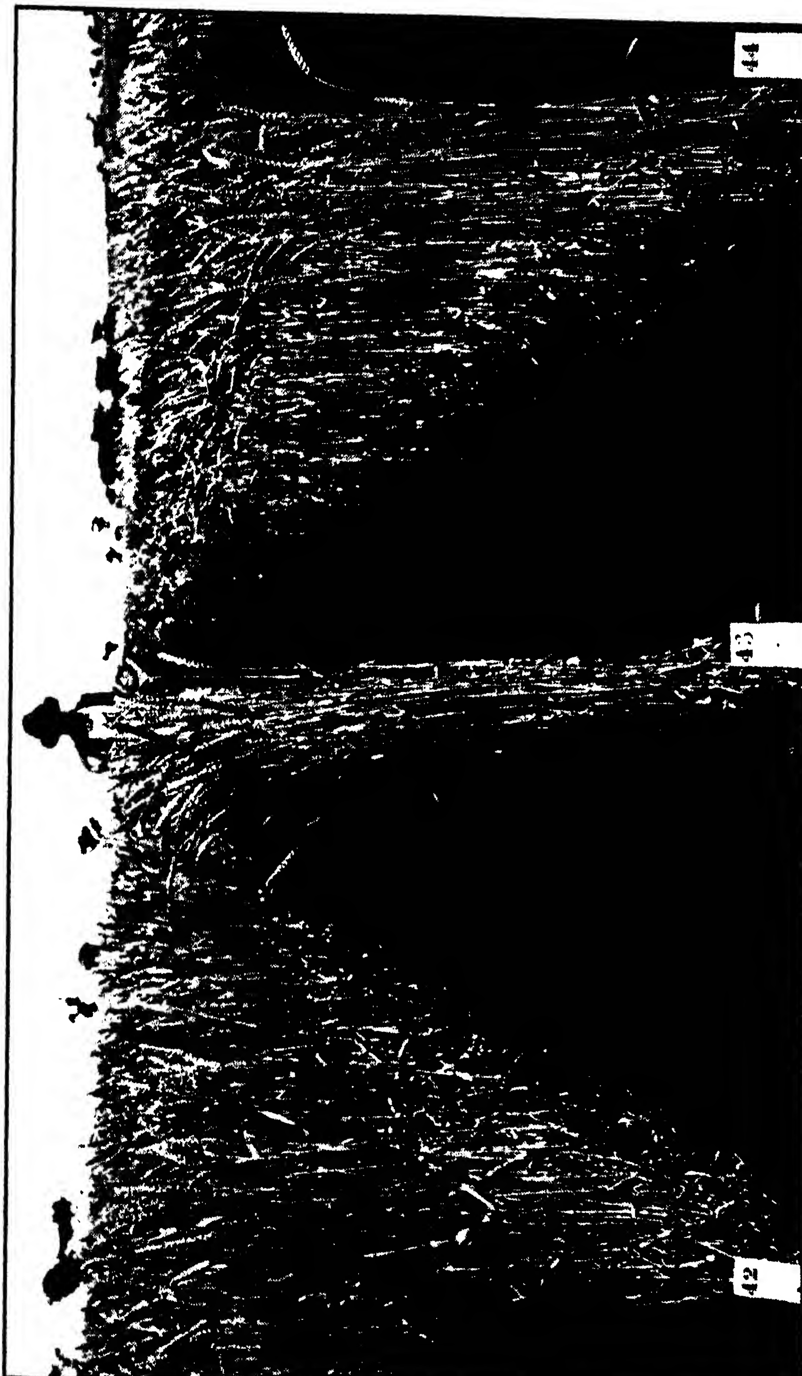
Waratah is the result of a cross made at Wagga in 1907, and was recently known as Wagga No. 47. The young growth is medium profuse, medium dark green and slightly glaucous. The straw is of medium height, semi-solid, rather slender and not purple. It comes into ear about the same time as Federation. The ear is brown, of medium length with a tip-awn of fair length. The grain is medium to large, dark yellow, slightly elongated, opaque, does not shell, but strips readily. Waratah belongs to the weak flour class and is a productive grain wheat in the west and south. Its pedigree is Hudson's Early Purple Straw x Gluyas.

Aussie (formerly Wagga No 51) is the result of a cross between Federation and Gluyas made at Cowra in 1907. Its young growth is similar to that of Waratah, but it comes into ear about a week earlier. The straw is of medium height, medium stout, semi-solid and white. The ear is awnless, white, of medium length, tapering in shape. The grain which does not shell is of medium size and regular shape, yellow, opaque, with crease of medium depth. It strips easily, and belongs to the weak-flour class. On the whole it resembles Federation more than Gluyas, and suits the Riverina district.

Stamina (or, as it has hitherto been known, Wagga No. 52) is a selection from the cross Federation x Thew, made at Cowra in 1908. This wheat has yielded well at Wagga Experiment Farm. It is a medium stooler, with a slightly more erect habit than Thew in its young growth. The ear is white and awnless, and the grain resembles that of Federation. The variety comes into ear about a week earlier than that wheat. It is perhaps better adapted for grain than hay, though one could class it as a general purpose wheat.

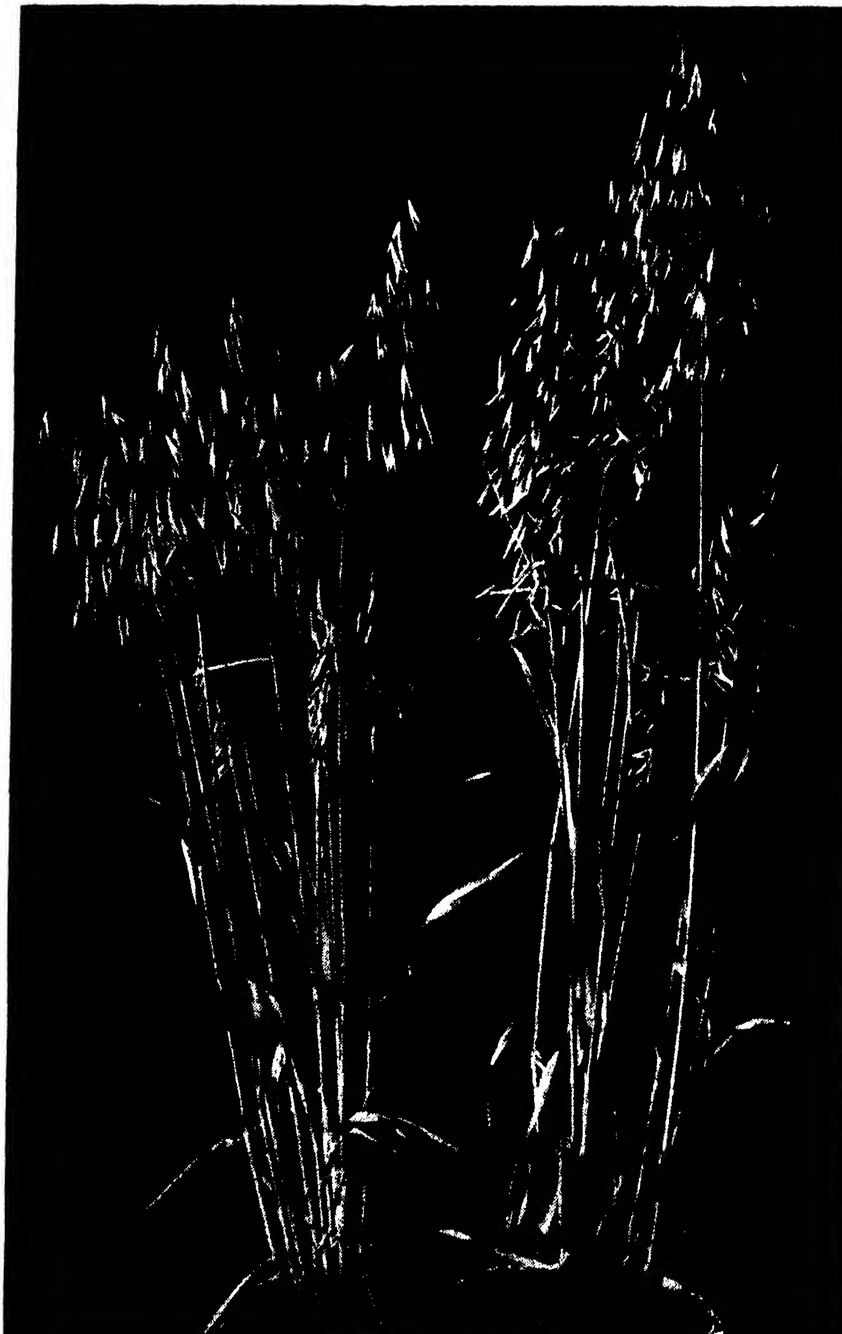
Union came from the cross Federation x Cowra No. 15, made at Cowra in 1914. A description of the father of this cross is given in the next paragraph. Union stools well in its young stages, and comes into ear about the same time as Federation. The straw is strong and of medium height. The ear is brown, slightly tapering, rather dense and awnless. The grain is yellowish white, opaque, does not shell, and appears from the milling results to be in the medium strong class. The variety stands up well at harvest time, and is very satisfactory to strip.

Nullah (formerly Cowra No. 15) has the following pedigree:—Emmer crossbred x Jonathan x Jonathan x Gunner x Tardent's Blue x Jonathan x 9 (F). The cross was made at Lambrigg in 1903. The young growth is rather abundant and prostrate, and the foliage dark green and glaucous. Its straw is somewhat short for hay purposes, and the flag is medium abundant. Its season is the same as Federation. The straw is not purple, and stands up well. The ear is white, uniform, dense, awnless, and of medium size. The grain is of medium size and regular shape, medium horny, and does not shell. The flour stands well up in the medium strong class. Nullah is not so hardy as some wheats, but yields heavily in a favourable season.



Wheat at Cowra Experiment Farm.

No. 42, Yandilla King; No. 43, Bomen; No. 44, Wandilla.



New Varieties of Oats.

On the left, Myall (formerly Cowra No. 27); on the right, Quandong (formerly Cowra No. 22), sown the same day.

Bald Knob (or Cowra No. 19) is a selection from the cross Redskin x Yandilla, made at Lambrigg in 1904. The young growth is medium sparse, and not very dark green. It comes into head at the same time as Federation with somewhat short, white straw of medium strength. The ear is white, awnless and dense with a blunt tip. The grain is white, soft, of medium size, threshes readily but does not shell. Bald Knob is a heavy grain producer of the weak-flour class; the straw is not so strong as that of Nullah. It thrives in the west and south.

Wandilla (formerly Cowra No. 20) came from the cross Federation x Yandilla King, made at Cowra in 1907. The young growth is medium profuse, procumbent, with dark glaucous green foliage. It comes into ear earlier than Yandilla King, the same season as Federation. The straw is white, of medium height, strong and stiff. The ear is white, tapering, rather long and awnless. The grain is yellow, of medium size, medium opaque, and usually of the medium strong class in the mill. It is a general purpose wheat, holding its grain well, and suits the same districts as Yandilla King, to which it is a strong rival.

Ghurka (formerly Cowra No. 24) is the progeny of the cross Yandilla King x Indian variety (Zaff), made at the Longerenong College, Victoria, in 1909. The young growth is sparse, not dark green, and the foliage not abundant. It comes into ear earlier than Canberra, and is about the same season as Clarendon. The straw is white, slender and short. The ear is brown with awns at the tip, and some other spikelets show a trace of awn. The grain is yellow, slightly elongated, of medium size and horny. It threshes readily, but is not at all inclined to shell. The grain is of the strong flour class, and equal to the best Manitoba for blending purposes. Ghurka has a high percentage of grain to straw, and suits the driest wheat districts, competing with Canberra.

Warrah (recently Hawkesbury No. 7) is the crossbred Warren x Florence x Huguenot x Clarendon, made at Cowra in 1915. The growth is erect, stooling moderate, and the foliage has a glaucous tint. It comes into ear with Hard Federation and the straw is tall, white, stout, and strong. It has a white, tapering, awnless ear. The grain is of medium size, white and a little hard to thresh. Warrah is rust resistant and very suitable for the coastal districts as a hay and fodder variety.

New Varieties of Oats.

Yarran (hitherto known as Bathurst No. 5) is a selection from the cross-bred White Ligowo x Algerian, made at Bathurst in 1905. Its young growth is medium, erect, dark green, with rather broad leaves. It comes into ear at the same time as Guyra, but the straw is rather taller with a purple tinge and medium coarse. The grain is light brown, of medium length, plump, and furnished with a stout awn. The panicle or head resembles that of Algerian. Yarran holds its grain well for stripping, but in one year was found to lodge. It is a good feed and general purpose oat for the medium cool to cool districts.

Wilga (or Bathurst No. 1F) resulted from the cross Red Rustproof x Big Four made in Bathurst in 1905. The young growth is rather like Yarran's, but its season is the same as that of Algerian. The straw is coarser than that variety, but not so coarse as the New Zealand white oats. The grain is brown, plump, of medium length and has a somewhat stout awn. The head is of the tree type, and the variety should suit districts for which Abundance is recommended.

Quandong (or Cowra No. 22) is a selection from Ruakura oats made at Cowra in 1914. The young growth is sparse and medium prostrate. It comes into ear earlier than Ruakura--about the same time as Sunrise. The straw is slender, tall, white and somewhat inclined to lodge, but stronger than Ruakura at Cowra. The awn is not coarse and the grain is pale dun, plump, and of medium length. The kernel has a comparatively high feeding value and thin husk. Quandong should succeed in the drier inland districts

Mulga (recently Cowra No. 25) is a selection from Sunrise oats, made at Cowra in 1915. The young growth is erect and sparse, and the leaves of medium breadth, glaucous, and not dark green. It heads a few days before Sunrise; the straw is tall, with a decided purple tint, and stands up slightly better than Sunrise. The grain is of good size, pale brown, with thin husk and somewhat stout awn.

Myall (formerly Cowra No. 27) is also a selection from Sunrise, made at Cowra in 1915. It is similar to Mulga, except that it stools rather better, and the straw is shorter. The grain is of good size, creamy brown, with thin husk. It heads at the same time as Mulga.

Barleys.

Trabut was one of a large number received in 1910 from Dr. Trabut, Economic Botanist in Algeria. The samples were numbered in rotation, and this was known as No. 36. Its young growth is medium prostrate, and the leaves medium dark and broad. It comes into ear at the same time as Cape, and the straw is of medium height and seldom lodges. The grain is bright yellowish-white, showing no blue tint—a very superior type of its class for brewing and feed purposes. The awns are similar in character to those of Cape, but the ear is shorter, broader, and more dense. Trabut thrives in any district where Cape is grown.

Pryor.—We received a parcel of Chilian 6-row barley in 1915 from Messrs. Tooth Co., and three plants of a 2-row type were ‹ und. in the crop that year. In subsequent seasons we found the barley to be a superior strain of the variety Pryor, already in cultivation; so that we are giving it the same name. The young growth is somewhat dark green, with rather narrow leaves and a free stooling habit. It comes into ear earlier than Kinver and Goldthorpe, being one of the earliest 2-row varieties. The straw is slender and somewhat short. The awns are fine and the ear of medium length, not so long as the Chevalier or so broad as the Standwell. The grain is of a bright golden colour, thin-skinned and plump. It has until now been known as Cowra No. 21.

A Variety of Rye.

Slav (recently known as Cowra No. 23) is a strain of the Schlanstedt variety which was received from Roseworthy College and grown at Cowra in 1916. The strain has been selected for earliness, and the young growth is more erect than that of other varieties. The straw, though of comparatively large diameter, is not coarse. The final crop is not quite so heavy as that of late maturing varieties, but fodder is obtained earlier in the season and it stands feeding-off well.

War with Cattle Ticks in the United States.

In the State of Georgia, U.S.A., where the cattle ticks are fighting a losing battle with Federal, State, and local government authorities, there are (according to the *Weekly News Letter* of the U.S. Department of Agriculture) no less than 3,291 dipping vats, in which cattle are immersed every fourteen days. Dipping began early in the spring, the time when the most effective results in tick eradication are obtained. During March, approximately half a million cattle splashed through the dipping vats in the State. The April reports show that 833,434 cattle were dipped under Federal, State, and county supervision.

Now all cattle that have been dipped in Georgia are marked with paint, and this plan has given very satisfactory results in getting to the dipping vats animals pastured on the open range that might otherwise miss regular dipping. The use of range riders, whose duty it is to search for and dip cattle that are not marked, was considerably increased during the spring.

In Georgia, as in all other Southern States where the fight against cattle tick has been waged, there has been more or less opposition to the tick-eradication movement, but there are also many who fully appreciate the present campaign and who throw all their weight into the scale in its favour, and one farmer actually wrote to the U.S. Department quite lately as follows: "In our part of the State, no man, no matter how unreasoning and bitter his opposition to tick eradication when we needed his moral support, can now be found who does not fully approve the work. No argument should carry more weight than the full indorsement and approval of opponents when they see the whole truth, and change from opposition to advocacy."

Sunflowers for Silage.

The developments of the last three years have brought the sunflower to the front as one of the most satisfactory crops that can be grown for silage purposes. . . . . From the experience I have had with this crop, I am satisfied that it will be developed until it is one of the main forage crops in the West, and because of its adaptability to a wide variety of conditions, such as drought, its suitability for irrigation, its resistance to frost, and its high feed value, it will mean millions of dollars of increased wealth to the stock growers of this country.—Professor G. H. Hutton in the *Agricultural Gazette of Canada*.

Plants which Produce Inflammation or Irritation of the Skin.*

In this Gazette. vol. XXII, part 12, page 1069 (December, 1911) there is a note in regard to the common ivy being a skin irritant to human beings.

This plant is one of very many that injuriously affect only one person here and there.

The following is another instance, brought under notice by Mr. W. M. Carne, Lecturer in Botany, Hawkesbury Agricultural College. He states that a winter student used to live with his parents at Greenwich Point, Sydney. The common ivy grew about the house, and on the three or four occasions upon which he clipped it, he was affected by a skin rash. On Saturday, 2nd July, 1921, on re-visiting his parents he again cut the ivy for the first time in eight years. On Sunday (3rd July) a skin irritation appeared on the eyelids, arms and hands, especially on the more delicate parts, such as between the fingers. His eyes are not affected. A rash has appeared on his arms, probably due to scratching, otherwise there is no outward evidence of a severe irritation.—J. H. Maiden.

The Inflammation caused by Plants, and its Treatment.

The occurrence of several cases of inflammation of the skin, the result of contact with certain kinds of plants, led the Department of Agriculture lately to ask the Director-General of Public Health if he could suggest certain simple methods of protection and treatment. The reply was as follows:—

Aids for Prevention.—If men are likely to be employed in handling plants liable to cause irritation it would be advisable that their forearms be protected by shirt sleeves, or some such covering, and cotton gloves. Smearing of the exposed parts with lanoline, vaseline, or lard, where the above method is a matter of objection, may possibly afford some means of protection.

It should be remembered, however, that some persons are more liable than others to the effects of irritant plants; personal idiosyncrasy plays an important part in this matter.

Methods of Treatment.—Should the skin show signs of irritation after contact with poisonous plants the application of several simple remedies may be efficacious, such as dusting with Fuller's earth, the application of oatmeal or bran water, or carron oil (which consists of equal parts of lime-water and linseed oil).

The following remedies are likely to be of still greater value, and may be procured from any chemist:—(1) An early application of calamine lotion, followed by the use of calamine ointment; (2) an application of 2 to 3 per cent. boracic acid lotion, followed by plain zinc oxide ointment.

If the skin affection tends to be of a severe type, resembling eczema, the use of Lassar's paste may be tried:—Acidi salicylici, 10 grains; zinci oxidi, 2 drachms; amyli, 2 drachms; paraffinum molle, up to 1 oz.

* Previous reference, this *Gazette*, March, 1921.

A Maize-growing Contest.

MANNING RIVER DISTRICT.

H. WENHOLZ, B.Sc. (Agr.), and J. M. PITT, Inspectors of Agriculture

THE first maize-growing competition conducted in the Manning River district by the Manning Agricultural and Horticultural Association, in co-operation with the Department of Agriculture, has been concluded most successfully.

For some time it has been evident to the Department that prizes given at agricultural shows for the best ten or dozen cobs of maize have the effect of encouraging the best type or variety of maize as judged on appearance alone, and that it does not necessarily follow that this maize is the best yielding variety, just as it has been found with dairy cattle that a test of performance or yield is the best indication of merit, being far superior to any judgment of points inclined by personal fancy and other supposed correlations between type and yield.

Several agricultural societies have realised the importance of field contests, and the one usually favoured with maize is the acre-yield contest, in which the prize is awarded to the farmer who produces the highest yield of marketable maize from a measured acre. Such a contest, however, unduly favours the grower who is fortunate enough to have the richest land in the district, while the farmer who has soil of only moderate fertility is hopelessly out of it from the start. Such contests have not been found to retain their interest very long. Further, it has been observed that the winner of such a contest receives a demand for seed of the variety that he grew which is far in excess of what is really justified—that is to say, farmers in the district have unjustly ascribed the results to the variety, and its seed was in consequence distributed all round the district to the undoubted detriment of the yield on many farms.

Now, in any maize-growing district there are usually a large number of varieties grown, and each farmer who grows the variety he fancies is ready to maintain that his choice is the best, *i.e.*, the highest yielding variety in the district. There is little doubt that too many varieties are grown in every district, and it should be the aim of a body such as the local agricultural society or association, which exists primarily for the progress and advancement of the district, to work in any direction that will have the effect of reducing the number of these varieties, by eliminating the poorest yielders and retaining only those which yield best. In this way the community gains not only in making maize-growing more profitable, but also in standardising the product on the market, which ensures a regular and brisk demand from the trade on account of the ease with which the variety can be located and because of wider familiarity with its quality.

With such a far-reaching and important end in view, the Department of Agriculture last season formulated details of a maize-growing contest, and

approached the agricultural societies on the chief maize-producing rivers on the coast with a scheme for their co-operation. Unfortunately, owing to the little time left before the beginning of the growing season, only one agricultural association of the three or four approached was able to initiate the contest last season, but the others have the matter well in hand for this season.

In order that these contests might be conducted on uniform lines, the following suggestions were made by the Department to the several societies or associations:—

1. The contest should be designed to be a test for the best variety or strain of seed maize in the district. Each competitor should accompany his entry with 5 or 10 lb. of his seed-maize to the secretary by a certain date. The variety should be stated, if possible, and also the locality where grown. The identity of this maize is kept unrevealed by giving each a number for the purpose of the contest.

2. Two or three farms, with as uniform land as possible, are selected in the district, on which a plot of each competitor's maize is sown under identical conditions, and the field given the same cultivation treatment throughout. Each plot should occupy about quarter acre, or at least three or four rows. The selection of two or three farms for conducting this contest is preferable to a single farm, owing to the possibility of failure due to unforseen conditions on one farm, and the loss of the contest for the year.

3. The contest might at first be limited to main crop varieties, and each maize should be sown at the same uniform rate in rows about 4 feet apart. Later on, a similar contest might be conducted for early varieties, if desirable.

4. After harvesting and weighing the maize, the produce will remain the property of the farmer on whose land the test was conducted.

5. Fertiliser may be used at the option of the farmer on whose land the test is made, in which case, the amount used should be the same on each plot.

6. When the crop is ready to harvest, the grower should notify the secretary of the society. An equal area of each plot should then be pulled, husked, and left bagged in the cob until thoroughly dry, when it should be shelled and weighed. The planting, pulling, shelling, and weighing should be done in the presence of the society's representative. For this purpose the Department of Agriculture offers gratuitously the services of the local Inspector of Agriculture for the entire supervision of the contest on behalf of the society, or, if desired, in conjunction with any sub-committee appointed by the society.

7. The best yielding strain or variety shall be determined by that seed showing the best average on the three farms on which the test is conducted.

8. The Department of Agriculture will make, if desired, non-competitive entries of three or four of the best varieties of maize secured from other parts of the State and from its own experiment farms.

9. The winner of the contest will be awarded a certificate of merit by the Department of Agriculture, and may expect a large demand for his seed not only in the district, but from other parts of the State.

The first contest of the kind was conducted by the Manning Agricultural and Horticultural Association. While the number of entries was poor, chiefly owing to the lateness of the season when the competition was arranged, it is satisfactory to observe that a very keen interest was maintained throughout. Altogether eleven entries were made—seven by local growers, and the remainder by the Department of Agriculture with varieties prominent in other districts, or grown on the experimental farms and not well known on the Manning. The entries were as follows:—

Improved Yellow Dent (now called Fitzroy) ...	Mr. D. Dorward, Cundletown.
" " " ...	Mr. J. P. Mooney, Cundletown.
" " " ...	Mr. V. Murray, Pampoolah.
Golden Beauty	Mr. R. Richardson, Mondrook.
Manning White	Mr. R. Richardson, Mondrook.
Manning Silvermine	Mr. R. Dyball, jnr., Taree Estate.
" "	Mr. S. E. Everingham, Moorlands.

In addition the following non-competitive entries of seed were made by the Department of Agriculture:—

Ulmarra Whitecap (formerly called Whitecap Horsetooth, from Clarence River).
Yellow Hogan (from the Macleay River).
Red Hogan (Hawkesbury Agricultural College).
Leaming (Grafton Experiment Farm).

Improved Yellow Dent (Fitzroy) was not entered by the Department as that variety, which has been bred and improved at Grafton Experiment Farm, was already known and sufficiently grown in the district to be entered by three competitors.

Five plots were offered for the competition, and the Department fell in with the society's suggestion to accept the lot for the first year's contest. They were at the following centres:—

Dumaresque Island	Mr. J. P. Mooneys' farm.
Pampoolah	Mr. V. Murray's farm.
Mondrook	Mr. R. Richardson's farm.
Moorlands	Mr. S. G. Everingham's farm.
Taree Estate	Mr. R. Dyball, senr.

The selected areas were rich portions of land, even in character, and, excepting a slight rise on the last mentioned, were quite level.

Sowings were arranged at intervals of about a fortnight, but, owing to adverse weather conditions, this could not be strictly adhered to.

The Plots.

Pampoolah.—Portion of an extremely rich paddock was selected for the plot. Soil alluvial; until last season paddock had been a cattle camping and feeding ground. Ploughed November, 1919; sown to maize late. Ploughed twice during winter and spring of 1920; sown 22nd September, 1920; excellent seed-bed; germination good; growth splendid throughout; harvested, 19th April.

Mondrook.—Sown 29th September. Withdrawn owing to uneven stand, caused by faulty machine sowing.

Taree Estate.—Rich loamy soil; portion of a paddock that had been under cultivation on and off for eighty years; land slightly undulating, fairly even in character. Previous crop, maize; ploughed twice before sowing on 14th October, 1920; germination good; growth good; Whitecap Horsetooth, Red Hogan, and Leaming became slightly blighted; harvested, 3rd May, and weighed 24th May.

Moorlands.—Rich volcanic soil; even throughout. Previous crop, maize; land ploughed twice during winter and spring; good seed-bed; germination good; growth excellent; plot slightly affected with blight and yield reduced somewhat; sown, 13th November; harvested, 25th May; weighed, 15th June.

Dumaresque Island.—Rich alluvial soil; previously cropped with maize. Ploughed and disced several times after removal of previous maize crop; sown, 18th December; germination fairly good; much rain fell during this month; harvested, 13th July; weighed, 8th August.

This plot, although sown late and having to bear the brunt of all the heavy autumn and winter storms, was free from blight and yielded very creditably.

The Season.

The season was remarkable for the heavy, continuous rainfall throughout. With the exception of the early spring months the falls were much above the average. The yield in consequence was very high, not only on the competition plots, but throughout the district. This applies chiefly to the earlier and mid-season sowings, the majority of the later sown crops being affected with blight. The rainfall on the plots ranged from 20 to 26 inches.

The Sowings.

Each entry was accompanied by about 12 lb. of grain. Four rows of each were sown across the area given on each of the four farms. Each plot was sown side by side on land as even as it was possible to obtain on the same day, and under identical conditions. Four grains of each were hand-dropped every 3 to 4 feet, in drills 4 feet distant. The Moorland and Dumaresque plots were fertilised with superphosphate at about 2 cwt. per acre, each plot receiving the same amount. Similar cultural treatment was given to each plot on the several farms, so it will be seen that success depended upon the yielding capacity of the variety or strain itself.

Harvesting Operations.

As each crop matured, the two centre rows of each plot were harvested, bagged, and numbered. It may be mentioned that each entry had previously been allotted a number to hide the identity during sowing and growth. Following harvesting it was threshed and weighed, and then, after allowing a period of from three to six weeks to thoroughly dry the lots, they were again weighed for the final figures. After the four plots had been dealt with in this manner, the average yield was obtained to ascertain the winner.

As will be seen from the table of yields the winning entry was Mr. D. Dorward's Improved Yellow Dent. This farmer thus gains the Department's certificate of merit. It was this strain's consistency throughout that won for it premier position. Only on one plot did it secure first place, and then in conjunction with Whitecap Horsetooth, but the average yield of 114 bus 44 lb. over all plots is a very fine one indeed. Improved Yellow Dent (now Fitzroy) has reached its present high standard by careful selection and breeding extending over a number of years at Grafton Experiment Farm. It has long been regarded as probably the best yielding variety under all conditions that we have on the North Coast.

That there are differences in yielding capacity between different strains of the same variety has been clearly demonstrated in this competition. A difference of over 20 bushels between entries of the same variety originally obtained from Grafton Experiment Farm shows the need for careful and systematic selection of seed for maintaining the yield of a variety of maize.

Whitecap Horsetooth (now Ulmarra Whitecap) finished second with an average of 106½ bushels to the acre. Being badly attacked with blight on the plot at Taree Estate no doubt influenced the yield. For many years it has yielded consistently on farmers' experiment plots.

Third and fifth positions were occupied by Manning Silvermine, a medium matured variety of white maize entered by Mr. S. E. Everingham and Mr. R. Dyball, jun. The original Iowa Silvermine was introduced by the Department many years ago, and was not regarded as a "record beater." Under coastal conditions the Manning strain, however, has now developed into quite a distinct type and yields remarkably well as the table indicates.

Manning White, entered by Mr. R. Richardson, occupied fourth position. It is a variety widely grown throughout the district and has always yielded prominently on farmers' experiment plots.

Golden Beauty also from the same farmer, behaved rather disappointingly in this contest. It is a maize with a long thin cob and small core, and on farmers' experiment plots conducted in the district over a number of years has occupied the leading position.

Red Hogan from Hawkesbury Agricultural College averaged over 100 bushels, giving its best yields on the earlier sown plots. Its comparatively low yield at Dumaresque Island was due chiefly to lodging, caused by heavy rain and wind.

Yellow Hogan, a variety widely grown on the Macleay River, also behaved best in the earlier sown plots. Its small core was a prominent feature.

Leaming, a variety of medium maturity and grown extensively throughout the North Coast, was another Departmental entry that yielded consistently throughout. It was rather badly blighted at Taree Estate. A prominent feature was the number of two cobs to the stalk.

YIELDS of Competing Maize per acre.

Competitor.	Variety.	Pampoolah plot.		Taree Estate plot.		Moorlands plot.		Dumaresque Island plot.		Average Yield per acre.	
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Mr. D. Dorward ...	Fitzroy (formerly Imp. Y. Dent).	131	6½	126	11½	100	30	91	19	114	44¾
Department of Agriculture.	Ulmarra Whitecap	146	3	84	26	104	13	91	19	106	29¼
Mr. S. E. Everingham	Manning Silvermine	117	6¾	123	42	101	16	64	46	101	42
Mr. R. Richardson ...	Manning White ...	120	3¾	130	7½	79	10	72	51	100	22
Mr. R. Dyball, jnr. ...	Manning Silvermine	132	33	123	42	74	33	69	54	100	12½
Department of Agriculture.	Red Hogan ...	136	15¼	101	36½	90	26	61	49	100	3⅜
Department of Agriculture.	Yellow Hogan ...	139	12¼	94	16	96	7	69	54	99	50¾
Mr. J. P. Mooney ...	Fitzroy (formerly Imp. Y. Dent).	128	9½	101	36½	88	42	76	34	98	44½
Mr. R. Richardson ...	Golden Beauty ...	117	48	121	44	82	7	70	40	98	6¾
Mr. V. Murray ...	Fitzroy (formerly Imp. Y. Dent).	126	39	102	8	86	31	53	43	92	16
Department of Agriculture.	Leaming	125	12½	77	5½	88	42	68	12	89	46

Owing to unforeseen conditions, it is thought that the location of the plots on Taree Estate did not favour the non-competitive varieties entered by the Department. which were sown on the outside of the field. If the results from this plot were excluded from the average, Ulmarra Whitecap (the Clarence River variety) would have obtained the best average yield, with Fitzroy entered by Mr. Dorward, a few bushels below it. Then would have followed Yellow Hogan from the Macleay River, and Red Hogan from Hawkesbury Agricultural College.

The results for this season must be regarded as a distinct triumph for Mr. Doward in his quick perception in recognising a good variety of maize, and maintaining its yielding capacity by careful selection of the seed.

Notes on the Varieties.

Fitzroy (lately Improved Yellow Dent).—This is a yellow dent maize maturing in from five and a half to six months; stalks tall; cobs borne high up, averaging about 9 or 10 inches in length, and well covered; grain fairly thick, deep, and very attractive, making a good variety for market; dent fairly rough: rows, fourteen to eighteen on cob; core moderately large; resists unfavourable conditions and fungus pests very satisfactorily; yields consistently, whether planted early or late.

Ulmarra Whitecap (Whitecap Horsetooth). A large pale yellow late maturing variety (six months); stalks tall; cobs borne fairly high up; average about 9 inches in length and thick; grain very rough, deep, and broad; rows fourteen to eighteen; core large; responds best under suitable climatic and rich soil conditions; cobs not well covered; its yield of 146 bushels to the acre at Pampoolah is probably the highest recorded officially on the Central Coast.

Manning Silvermine.—A white variety maturing a shade under five months; stalks average about 9 to 10 feet; cobs borne on long shanks causing a drooping appearance when maturing; stalks usually carry a fair percentage of two's; cobs about 8 inches long, moderately thick; fourteen to eighteen rows; grain, medium rough, narrow, and very deep; cores small. Manning Silvermine is now a distinct type of Silvermine, the main differences being that the local type is slightly later in maturity, the number of rows slightly less, and furrows between rows wider; it seems to do better (like most early maturing varieties) when planted early.

Manning White.—A variety maturing in about five and a quarter months; stalks about 9 to 10 feet high; cobs about 8 inches in length, moderately thick; grain smooth, but dented and wider than Silvermine; thick and fairly deep; rows twelve to fourteen; core small. Like Silvermine, this is a good yielder planted early and under adverse conditions; largely grown on the Manning and Macleay.

Red Hogan.—A very late maturing variety, occupying nearly six and a half months; stalks tall and stout; cobs borne high up; average 9 to 10½ inches

in length, very thick; core coarse; grain thick, fairly broad, and deep, and of a reddish colour, with yellow cap; about fourteen to eighteen rows on the cob; rather difficult to ripen when sown late; a variety that responds well in good soil and under good climatic conditions.

Yellow Hogan.—A late maturing (six months) yellow variety; stalks moderately tall, but not a rank grower like Red Hogan; cobs borne average height; about 8 to 9 inches in length and slightly tapering; about sixteen rows on the cob; core small; grain bright yellow, narrow, thick, and deep; a variety likely to become popular owing to its excellent bag-filling capabilities.

Golden Beauty.—A variety maturing in five and a half to six months; stalks tall; cobs, which are usually of exceptional length, average 10 to 12 inches and thin; borne at an average height; cores thin; grain wide, smooth, fairly deep, and of a palish yellow colour; a very attractive market sample; about twelve rows to the cob. The later sowings are sometimes susceptible to blight.

Leaming.—One of the most popular moderately early (five months) maturing varieties grown in the State; stalks not tall; cobs mostly two's, borne at a nice height; cobs about 8 inches in length and slightly tapering; narrow, usually eighteen to twenty-two; grain roundish and fairly deep; tight on core, which is small; grain of rather a darkish yellow colour, with a palish cap; very attractive shelled sample. This variety always seems to give satisfaction whether sown early or late.

The prize for the highest yielding plot, given by the Manning River Agricultural and Horticultural Association, was won by Mr. V. Murray, his plot giving the greatest average yield.

Conclusions.

The competition has settled for the year, at any rate, the possessor of the heaviest yielding strain of maize. Farmers, especially maize growers, have become notorious for the high opinions they hold of their own maize; it is usually "at least the equal of, if not superior to, any other grown." Such statements as these, of course, are best remedied by contests of the kind just held. Whilst all could not gain the premier position, the contest should act as a very necessary stimulant to the unsuccessful men, and to other maize growers, to double their efforts for the next contest, either by a more careful selection of their seed, or by adopting a variety known to have higher yielding capabilities. Should methods such as these be followed, the competitions must eventually have a marked influence upon the yields and profits from maize-growing throughout the district. The advantages of the contest have been already seen in the enormous demand by farmers in other districts for seed from the leading growers, and in the co-operation with the Department in the introduction to the district of high yielding varieties of maize which have come under its notice in other parts of the State.

The rich soil on the plots, the very favourable season, an almost perfect stand, and the first-class seed sown (all being good types of the various varieties) were the contributing factors to such high yields.

The success of the present competition was in a large measure due to the active support of the President of the Manning Agricultural Society, Mr. G. T. Clarke, and other members of the association.

The Cultivation of Hops.

A good class of soil, that has been well drained, is required for hops, and it should be subjected to the methods of preparation usual for planting fruit trees. The crop is specially suited to districts such as Batlow The plant is propagated from suckers taken from old plants; they are cut off about ¼ inch from the root stock and are shortened to a length of about 5 inches. As a general rule, these sets are first placed in the nursery, so that rooted plants may be obtained, and under conditions similar to those in this State the correct time for setting out is August. The plants are set out about 6 feet apart each way.

During the early period of growth the land should be kept well cultivated and free from weeds. After the first year's growth each plant is staked with three poles about 12 feet long, driven into the ground in such a way that they are slightly inclined from the vertical, so as to admit light and air to the centre. The hops begin to shoot about the end of August, and by the end of September are about 18 inches long. Extra long plants and weak shoots should be removed, and about six to eight good average shoots left to each plant.

From two to three vines are twined "clockwise" around each pole, and tied so as to keep them in place. The land should be kept well cultivated until the young female flowers have turned into the hop. This occurs about the middle of December, and about the end of February the hops are matured and ready for picking a stage indicated by the hops turning from a deep green colour to a lighter yellowish green or straw shade.

Picking is done about the early part of March, when the vines should be cut at a height of about 2 feet 6 inches from the ground and the poles pulled out; the vines are usually allowed to fall on to a tressle for convenience in picking. Hops must be dried before they are marketed, and sun-drying is usually practised, but in moist climates it would probably be necessary to arrange for a small plant for drying the crop by means of hot air.—A. H. E. McDonald, Chief Inspector of Agriculture.

Herd-testing and the Calves.

Wrote a Wisconsin farmer after he had had his dairy cows tested for the first time: "I had two cows that had freshened about three weeks before that, and both of them had heifer calves which I intended to sell for veal; but after the test was made I saw that those two cows were making more butter-fat for the month than any of my other cows. I decided to keep the calves and further took interest enough to weigh the milk from each cow in my herd; and now those two cows are on the top of the list for the whole testing association. You may ask, what about those two calves? Well, if you have 300 dollars you might get them; but not for less than that, even if they are grades."

Farmers' Experiment Plots.

SUDAN GRASS TRIALS, 1920–21.

Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Assistant Inspector of Agriculture.

EXPERIMENTS with Sudan grass were conducted with the co-operation of the undermentioned farmers during last season:—

H. Booth, Farm 854, Whitton.
J. Leitch, "Glenlee," Brobenah.
F. Hopley, Farm 317, Leeton.
W. Edwards, Farm 367, Leeton.
H. Hogbin, Farm 897, Griffith.

From the point of view of growth, the season was everything that could be desired, although in several instances rain delayed sowing operations. Very little irrigation was necessary, the grass making good growth on the natural precipitation. The season was also marked by an absence of dust-storms and hot winds.

The rainfall registrations were as follows:—October, 168 points; November, 153; December, 386; January, 217; February, 65; March, 178; April, 123.

Cultural Methods.

In all instances the land received a short fallow to sweeten and prepare a suitable seed-bed. Different methods were adopted with the sowing, some being sown through the grass-seed box, some by mixing with the fertiliser and sowing both through the fertiliser attachment, and some by sowing through the ordinary wheat hopper. The last method is usually adopted when sowing in rows 3 feet apart.

A very even stand is obtained by mixing the seed with the fertiliser, as the small seed lends itself to ready mixing. If it is desired to sow in rows 14 inches apart, it is usual to put two tubes into the one hoe.

The heaviest yields were obtained when the sowing was in rows 3 feet apart, as it is then possible to furrow irrigate, and if necessary cultivate, although in most instances the crop only receives at most one cultivation.

If the grass is grown for grazing, the method most in favour appears to be in drills 7 inches apart, as even though a tall growth is obtained, the stalks are much finer. It is usual when the grass is grown thus to throw up check banks from one to one and a half chains apart to facilitate watering. The seed is sown in a well prepared seed-bed as soon as the warm weather appears, as the grower is then able to obtain two cuts, and then to utilise the third growth as a grazing proposition.

In many cases sowing is delayed until December, but the growing season is made short, and one may expect trouble if the season turns dry, necessitating irrigation before the young plants have made much growth. Unless the soil is well-worked and carrying a high content of moisture, it may even dry out before the seed germinates, as it is usual not to sow at a great depth. The use of a light roller or the ordinary harrow turned upside down, weighted and dragged over the land, will tend to hasten germination.

Details of the Plots.

Farm 854.—Seed sown on red clay loam; previous crop, maize unmanured; ploughed in September, harrowed and check banked in October; sown, 14th October, in drills 14 inches apart, at the rate of 8 lb. per acre, with 70 lb. superphosphate. This plot was sown to obtain data as to the carrying capacity of Sudan grass. The stock were first depastured in December on an area of 6 acres—thirty-two head in all for ten days. On removing the stock, the paddock was irrigated, and ten days later was again grazed for ten days. The grass responded very quickly after the removal of the stock, and the following periods of feed were obtained :— From 15th to 18th January, 4th to 14th February, 1st to 16th March, 30th March, to 6th April, 14th to 28th April. With the exception of the last period, when twenty-four head were grazing, there were thirty-two head of milking cows on the grass for each period. The carrying capacity was thus thirty-two head for a period or periods in all of fifty-eight days, and twenty-four head for a period of fifteen days. The cows responded well to the feed, maintaining their yield of butter, and in many cases increasing their flow of milk.

"*Glenlee.*"—An area was sown on this farm under dry-farming conditions with very satisfactory results. The soil was a red sandy loam; the previous crop had been wheat. The main idea of this plot was as a feeding test to determine the harmful effects or otherwise of grazing stock on Sudan. Sheep, cattle, and horses were fed at all stages of growth without any ill effects, as reported in another paper.

Farm 317.—A manurial test was conducted on an area of 3 acres, and one plot was sown with local seed. This land had not been cropped for some years; it consisted of a red loam. The land was ploughed and disced in September, cultivated in October, irrigated on 21st October, cultivated with the set-tine previous to sowing on 28th October in drills 7 inches apart, the seed being mixed with the fertiliser. The local seed made most growth, attaining a height of 7 feet, and when cut in January the plot yielded over 7 tons of green fodder per acre. The second cut of this particular plot was not as good as the others in the trial. The plots received one watering in February.

Farm 367.—In this instance the seed was sown in drills 3 feet apart on rather heavy soils. Previous crop, lucerne; ploughed in October; irrigated in November; disced, 17th November; harrowed, 18th November; sown,

19th November, at the rate of 8 lb. seed per acre. Six plots were sown with various mixtures and quantities of fertiliser. The grass was cut on 5th February and again on 21st March. All the manured plots gave much heavier yields than the unmanured portion. The second growth received two waterings in the end of February and beginning of March.

Farm 897.—A manurial trial was carried out on this farm. The soil consisted of red sandy loam, not been previously cropped. The seed was sown in drills 3 feet apart on 10th November. A excellent germination was obtained, and the crop was making very good growth until it was attacked by grasshoppers in January, with the result that the first cut was spoilt so far as obtaining comparable weights was concerned. A cut was obtained from the second growth on 23rd March with satisfactory results.

The weights of green feed obtained on the various farms were as follows:—

	1st Cut.				2nd Cut.				Total.			
Farm 317.												
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
½ cwt. P7	7	8	3	21	5	6	0	8	12	15	0	1
½ ,, P8	6	18	2	0	4	9	1	14	11	7	3	14
½ ,, Superphosphate	6	17	1	14	3	13	2	18	10	11	0	4
½ ,, Superphosphate (local seed) ...	7	19	3	0	4	7	1	14	12	7	0	14
Farm 367.												
1⅝ cwt. M7	4	18	1	16	4	10	2	26	9	9	0	14
280 lb. Superphosphate	4	16	3	0	4	6	3	4	9	3	2	4
1⅞ cwt. M5	4	12	2	0	4	7	0	24	8	19	2	24
2¼ ,, P7	4	12	0	0	4	15	3	1	9	7	3	1
140 lb. Superphosphate	4	10	2	7	3	16	3	25	8	7	2	4
2 cwt. M6	4	9	2	6	3	19	1	7	8	8	3	13
No manure	3	19	2	6	2	17	1	23	6	17	0	1

Farm 897.

	t.	c.	q.	lb.
2½ cwt. Superphosphate	4	1	2	0
140 lb. Superphosphate	3	16	1	7
2 cwt. M6	3	16	0	12
1⅞ ,, M5	3	9	1	0
1⅝ ,, M7	3	2	1	9

The mixed fertilisers are made up as follows: P7, equal parts superphosphate and bonedust; P8, equal parts superphosphate and blood and bone; M5, 2 parts superphosphate and 1 part sulphate of ammonia; M6, 5 parts superphosphate and 3 parts chloride of potash; M7, 10 parts superphosphate and 3 parts chloride of potash.

An old road had run across the last plot, and although it was not noticeable at sowing time, the whole plot appearing similar throughout, the grass sown with M7 mixture did not respond as the others. It will be noticed that P7 gave the best yields throughout, but M7 and heavy dressings of superphosphate also gave heavy returns.

To arrive at anything definite and conclusive with fertiliser trials under irrigation is a very delicate matter. In the first place, the soil varies considerably even in a few yards, and again, no matter how careful one may be in applying the water, without actually measuring the quantity (which is not practicable on the farm) a good deal of guesswork has to be done as to when a plot is sufficiently watered. Thus one plot may get more water than another, thereby perhaps increasing its yield, or possibly having the opposite effect, whereas with the natural rainfall the amount is very unlikely to vary appreciably on so small an area.

Do Italian Bees Destroy Sound Fruit.

A fruit-growing correspondent is convinced that he has a case against the apiarist—at any rate, against the apiarist's Italian bees. With the contention that bees are not "provided with natural tools" for attacking undamaged fruit, he is flatly at variance. The old British bee did not harm the fruit, he claims, and "the great attraction of the new Italian bee to apiarists seems to be the fact that they live on the fruit of the neighbouring orchards instead of going short of food in times of scarcity of blossoms" His peach and plum crop, was practically all destroyed by Italian bees on one occasion, and although this year they were doing little harm, he was forced to pick his fruit before it was ripe. In the Government's importation of Italian bees he sees neglect of fruit-growers' interests.

Extensive tests carried out in New South Wales go to prove that bees do not damage sound fruit, though it has been noticed that where fruit has been previously damaged by birds, wasps, &c., bees will, during a severe dearth of nectar, suck the juices through the damaged portion, often widening the puncture. From our experience Italian bees go after fruit juices no more than other races of bees, the old English bee included. Large numbers of Italian bees have been kept in New South Wales for the past thirty years, and apiaries worked in the vicinity of orchards and vineyards, yet rarely has the orchardist complained of any damage; in fact, in many cases fruit-growers have offered a piece of their land for the use of the bee-keeper gratis, recognising the advantage to be gained in the way of better pollination. One of my own apiaries, of 120 colonies of Italian bees, was situated for fifteen years within 100 yards of an orchard where peaches and plums were growing, and not in one case did we find that sound fruit was interfered with.

Concerning the old English bee, from notes from an English publication the race is practically extinct, because of its non-immunity to disease. The loss to English fruit-growers was estimated at over £2,000,000 for one season, owing to the loss in bees caused by the Isle of Wight disease. Italian bees have been imported by the British Government to assist the fruit-grower and apiarist.

Experts recognise the superiority of the Italian race of bees, and practical fruit-growers generally are not afraid of the bees attacking their fruit. In New South Wales many fruit-growers work an apiary of Italian bees as a side line, and in my experience as Inspector I have not heard one genuine complaint. In most cases the desire was for more bees.—W. A Goodacre, Senior Apiary Inspector.

Notes on Wheats entered for the Royal Agricultural Society's Show.

EASTER, 1921.

F. B. GUTHRIE AND G. W. NORRIS.

THE wheats entered for the 1921 Show were, as will be seen from the judges' report, of a good standard, comparing favourably with previous years. The total number of individual entries was 96, and the prize money allotted to the section amounted to £136.

The prizes were fairly evenly distributed, Mr. Smith Pollock with three first prizes, and Mr M. J. D'Arcy with two firsts heading the list. Mr. A. R. Michael of Victoria, a comparatively new exhibitor, who has previously had bad luck, is to be congratulated on tying for third place in the prize-winners with Mr. W. H. Scholz, who has been consistently successful for many years. An old exhibitor, Mr. W. Clark of Angle Vale, South Australia, who has been a consistent winner in the macaroni class, was not represented this year.

The special prize for Yandilla King, introduced last year, was withdrawn, and a special novice prize for Federation substituted, in the hope of increasing the list of prize-winners.

An innovation was introduced in the method of exhibiting the samples in the Farrer Court. The competing samples were shown in shallow glass-covered boxes placed against the wall, instead of in linen bags as in previous years. This arrangement not only enabled the individual samples to be displayed to better advantage, but greatly improved the appearance of the court, by doing away with the unsightly bags and allowing the award cards and the various classes to be more clearly distinguished. The alteration was appreciated both by the exhibitors and the public, and it is hoped that this year's experience will enable still further improvements to be introduced by next Easter.

It is a matter for regret that the special class for the best bag of Federation wheat was so poorly represented. Only one exhibitor competed, and as his exhibit was unfortunately Hard Federation it had to be outclassed. The lack of competition is the more surprising as the prize money (£20) was the largest sum allotted to any individual class in this section. The entries for the novice-class for Federation were also disappointing, there being only three, one of which was outclassed, while another was a badly bleached sample. The exhibit which was finally awarded the prize was not of the highest standard, and, in the judges' opinion, "bordered perilously on the 'Hard type."

Otherwise the classes were well-filled and the competition close and keen.

The judges were Messrs. R. W. Harris (Gillespie Bros.) and G. W. Norris (Department of Agriculture), the milling of the samples being carried out by Mr. Norris.

The judging was carried out as in previous years. The bushel weights of all samples were first taken: the results are given in the second of the accompanying tables. After careful inspection to eliminate inferior exhibits, those which were considered eligible for prizes were milled in the model mill of the Department of Agriculture, and the prizes finally awarded in accordance with their actual behaviour in the mill, points being assigned for the different milling characteristics.

The results of these tests are given in the table headed "Results of Milling Tests," in which the figures within brackets are the actual figures obtained, the others being the marks assigned.

What the Judges Said.

The following is extracted from the judges' report:—

Both in quality and weight the wheats are good: they might even be classed as excellent. Here and there a weak sample appears—grain that shows signs of weathering. We have no hesitation in classing the general standard as materially ahead of the quality of last two shows.

The premier sample is the winning exhibit in the strong red class, a lot of exceptional quality Cedar, shown by S. Pollock, of Quirindi. Under the old-time custom of awarding a champion prize, there would have been nothing in the section to compare with it. As an example of high-grade milling wheat it stands right out. It gained 94·5 points out of the possible 100, and tested 54·4 for flour strength, 75·4 per cent. of flour, and 14·7 per cent. gluten. The bushel weight is 66¼ lb. Another sample of Cedar, exhibited by A. R. Michael, of Woomelang, Victoria, was placed second, with 90·5 points.

The macaroni type prize went to Huguenot, shown by M. J. D'Arcy, of Berrigan, who was also equal second with Indian Runner and Velvet Don.

The old Farrer wheat, Bobs, makes a reappearance in the strong white class, and wins for S. Pollock with 90·5 points. The outstanding feature of the sample is a flour strength of 53 per cent., added to 14·3 per cent. gluten and 73·2 per cent. flour. D. and J. Gagie, West Wyalong, share second honors with 89·5 points, for Comeback.

The Florence variety carries off both awards in the medium strong class, A. R. Michael scoring 88 points for first, and W. H. Scholz, of Gilgandra, 4 points less. The winning sample tested out 52·5 per cent. flour strength, which really raises it to the strong flour class.

The special of £20 for the best bag of Federation only brought out one exhibit, and, as that was a sample of Hard Federation, it was passed over. Again, in the special class for bag of Federation shown by a "novice" exhibitor, the best exhibit is of Hard Federation, and R. J. D'Arcy won with a sample bordering perilously upon the Hard type, the weight of which is 67 lb.

When it came to the Hard Federation special, T. Bragg, of Mungeribar, won well in a large, even, and strong class.

Petatz Surprise, shown by S. Pollock, a sample of particularly fine colour and 45·4 flour strength, ranked first in the weak flour class, with 82 points, D. and J. Gagie's Gresley, testing 46·8 strength, being a point behind.

Scoring a total of 212½ points out of a possible 225, M. J. D'Arcy took first for collection of five Farrer wheats, comprising an exceptionally good lot of Comeback, Cedar, Cleveland, Federation, and Florence. An even better achievement was that of W. H. Scholz, Gilgandra, in gaining 220 points for collection of five non-Farrers, consisting of Pusa 4, Pusa 107, Prelude, Hard Federation, and Minister. As the points indicate, this collection is hard to penalise.

The heaviest sample is one of Prelude, shown by W. H. Scholz, which weighs 68 lb.

TABLE showing average bushel-weights, gluten-content, and water-absorbing power of wheats of the "Strong White" and "Soft White" classes milled at the Royal Agricultural Society's Show, from 1905–1921.

Year.	Weight per bushel.		Gluten.		Flour Strength. (Water-absorption, quarts per 200 lb. sack.)	
	Strong White.	Soft White.	Strong White.	Soft White.	Strong White.	Soft White.
	lb.	lb.	per cent.	per cent.		
1905	63	64	10·0	9·7	46·6	45·2
1906	63¾	64½	11·0	9·8	48·5	45·7
1907	62½	66	9·3	8·3	48·4	45·4
1908	64½	65	12·2	10·2	52·5	46·4
1909	64¾	65¼	11·9	8·6	53·5	49·2
1910	64½	64	13·8	12·1	50·0	47·8
1911	64½	63½	12·5	11·0	53·4	47·0
1912	65	64	13·4	10·6	52·7	45·2
1913	67	65¼	15·2	11·7	53·1	46·9
1914	67¼	67	12·8	10·6	52·3	45·0
1915	67½	66½	13·1	12·4	53·8	45·7
1916	67¼	67¼	13·0	12·3	53·3	47·5
1917	66	67½	12·4	8·6	54·6	43·0
1918	67	65¾	-	10·2	*	44·5
1919	67½	66¼	10·5	8·9	52·7	43·6
1920	67	65½	13·6	11·5	51·3	44·7
1921	66	64¾	13·0	11·0	52·6	45·1

* There were only two entries in the Strong White class in 1918, and these were readily differentiated by the judges without subjecting them to a milling test. The figures for gluten and flour strength are therefore not available.

The above table shows that the quality of our wheat, as far at all events as show samples are concerned, maintains itself well. Both in gluten-content and in flour strength there is a gradual but marked improvement in the seventeen years covered by the table, especially in the strong-flour class.

WEIGHTS PER BUSHEL.

Catalogue No.	Variety.	Bushel-weight.	Catalogue No.	Variety.	Bushel-weight.
		lb.			lb.

Class 1022 (Macaroni Wheat).

6684	Huguenot	66½	6688	Kubanka	66¾
6685	Indian Runner	66¼	6689	Huguenot	64¾
6686	Medeah	65¾	6690	Medeah	63½
6687	Velvet Don	67			

Class 1023 (Strong Red).

6691	Cedar	67¾	6694	Cedar	66¼
6692	,, ...	65	6695	Prelude	68
6693	,, ...	67¼			

Class 1024 (Strong White).

6696	Bobs	66½	6702	Comeback	65¼
6697	Comeback	66¼	6703	,, ...	63¾
6698	,, ...	66¼	6704	,, ...	67
6699	,, ...	66¼	6705	,, ...	66¾
6700	,, ...	67¼	6706	,, ...	65¼
6701	Bobs...	65¼			

Class 1025 (Medium Strong).

6708	Hard Federation	65¾	6716	Canberra	66
6709	Florence	65	6717	Rymer	63
6710	Canberra	66½	6718	Yandilla King	62¼
6711	,, ...	66¼	6719	Florence	67
6712	Florence	65	6720	Canberra	65
6713	,, ...	66	6721	,, ...	66½
6714	Hard Federation	66	6722	,, ...	65½
6715	Yandilla King	65¾			

Class 1028 (Federation ; for exhibitors who have not won a prize).

6725	Hard Federation	65¾	6727	Federation	59¼
6726	Federation	67			

Class 1029 (Hard Federation ; for exhibitors who have not won a prize).

6729	Hard Federation	65¾	6733	Hard Federation	65½
6730	,, ...	66¼	6744	,, ...	64¼
6731	,, ...	63½	6745	,, ...	65¾

Class 1030 (Weak Flour).

6736	Warden	64½	6741	Dart's Imperial	62¾
6737	Hudson's E.P.S.	64½	6742	Steinwedel	62½
6738	Warren	65¾	6743	Petatz Surprise	66
6739	Gresley	65½	6744	Purple Straw	66
6740	Currawa	61¼			

RESULTS OF MILLING TESTS.

	Appearance of Grain.	Weight per bushel.	Ease of Milling.	Percentage of Flour.	Colour of Flour.	Percentage of dry Gluten.	Strength.	Total.
Maximum Points.	10	15	10	10	15	20	20	100
Catalogue No.								
Class 1023 (Strong Red).								
6692	8	[65½] 12·5	8	[72·4] 9	14	[12·5] 17	[53·4] 18	86·5
6693	9	[67¼] 14·5	8	[73·8] 10	15	[11·7] 16	[54] 18	90·5
6694	10	[66¼] 13·5	8	[75·4] 10	15	[14·7] 19	[54·4] 19	94·5
6695	9	[68] 15	8	[73·6] 10	15	[14] 18	[48·4] 13	88·0
Class 1024 (Strong White).								
6698	10	[66¼] 13·5	9	[72·8] 9	15	[12·3] 16	[53] 17	89·5
6700	9	[67¼] 14·5	9	[75·2] 10	14	[10·5] 14	[54] 18	88·5
6701	10	[65¼] 12·5	9	[73.2] 9	15	[14·3] 18	[53] 17	90·5
6702	9	[65¼] 12·5	9	[75·6] 10	15	[14·3] 18	[51·2] 15	88·5
6706	10	[65¼] 12·5	9	[74·8] 10	15	[13·8] 17	[51·6] 16	89·5
Class 1025 (Medium Strong Flour).								
6713	10	[66] 13	10	[72·6] 9	15	[10·6] 14	[52·5] 17	88·0
6714	10	[66] 13	10	[72] 9	14	[9·4] 13	[49] 13	82·0
6715	10	[65¾] 12·5	10	[72] 9	12	[10·5] 14	[46·8] 11	78·5
6719	10	[67] 14	10	[74] 10	13	[12] 16	[46·6] 11	84·0
6721	10	[66½] 13·5	10	[72] 9	13	[10·2] 14	[46·4] 11	80·5
6722	10	[65½] 12·5	10	[72·4] 9	14	[11·5] 15	[46·8] 11	81·5
Class 1030 (Weak Flour).								
6738	10	[65¾] 12·5	10	[73] 9	13	[10·9] 15	[46] 10	79·5
6739	10	[65½] 12	10	[74·8] 10	14	[10·7] 14	[46·8] 11	81·0
6743	10	[66] 13	10	[73] 9	15	[11·3] 15	[45·4] 10	82·0
6736	8	[64½] 11·5	10	[71·1] 8	14	[11·3] 15	[44] 9	75·5
6740	7	[61½] 10	10	[70·4] 7	13	[10·6] 14	[43·2] 8	69·0

RESULTS OF EXAMINATION OF THE WHEATS IN CLASSES WHICH WERE NOT SUBJECTED TO MILLING TEST.

Catalogue No.	Variety.	Weight per bushel.	Appearance of Grain.	Trueness to Type.	Uniformity.	Total.
	Maximum Points.	10	10	10	10	45

Class 1022 (Macaroni Wheat).

Catalogue No.	Variety.	Weight per bushel.	Appearance of Grain.	Trueness to Type.	Uniformity.	Total.
6684	... .	[66½] 13·5	9	10	10	42·5
6685	... .	[66¼] 13	9	10	10	42·0
6686	....	[65¾] 12·5	9	10	9	40·5
6687	....	[67] 14	10	9	9	42·0
6688	.. ..	[66¾] 13·5	10	9	9	41·5
6689	....	[64¾] 11·5	9	10	10	40·5
6690	.. ..	[63½] 10·5	8	9	9	36·5

Class 1031 (Collection of Five Farrer Wheats).

Catalogue No.	Variety.	Weight per bushel.	Appearance of Grain.	Trueness to Type.	Uniformity.	Total.
	Cedar	[67½] 14·5	9	9	9	41·5
	Cleveland ..	[67¾] 14·5	10	10	10	44·5
6745	Comeback ..	[66¼] 13·5	9	10	10	42 5
	Federation ...	[65¼] 12·5	10	10	10	42·5
	Florence .	[65¼] 12 5	9	10	10	41·5
						212·5
	Bobs	[65¼] 12·5	10	10	10	42·5
	Canberra ...	[65½] 12·5	6	10	8	36·5
6746	Cedar	[65¼] 13·5	10	10	10	43·5
	Comeback ..	[65½] 12·5	10	10	10	42·5
	Rymer	[63¼] 10·5	8	9	9	36·5
						201·5
	Bomen	[66¼] 13·5	8	9	9	39·5
	Canberra ..	[66¼] 13·5	10	10	10	43·5
6747	Comeback ...	[66¾] 13·5	8	8	8	37·5
	Florence . .	[66¾] 13·5	9	9	9	40·5
	Hard Federation	[64½] 11·5	9	9	9	38·5
						199·5

Class 1031 (Collection of Five Farrer Wheats)—*continued*.

Catalogue No.	Variety.	Weight per bushel.	Appearance of Grain.	Trueness to Type.	Uniformity.	Total.
	Bomen	[63½] 10·5	6	8	8	32·5
	Canberra ...	[65¾] 12·5	10	10	10	42·5
6748	Comeback ..	[65¾] 12·5	10	10	10	42·5
	Hard Federation	[65¼] 12·5	8	8	10	38·5
	Rymer	[65¾] 12·5	9	9	9	39·5
						195·5

Class 1032 (Collection of Five Non-Farrer Wheats).

Catalogue No.	Variety.	Weight per bushel.	Appearance of Grain.	Trueness to Type.	Uniformity.	Total.
	Kharkoff ..	[65¼] 12·5	8	9	9	38½
	Kitchener ...	[65] 12	8	9	9	38·0
6749	Red Bobs ...	[65] 12	9	9	9	39·0
	Ruby	[65¼] 12·5	9	10	10	41·5
	Snowy River ..	[65¾] 12·5	10	10	10	42·5
						199·5
	Gallipoli ...	[66¾] 13 5	10	10	10	43·5
	Gresley ..	[66¼] 13·5	10	10	10	43·5
6750	Joffre	[66] 13	9	10	10	42·0
	Minister ...	[66¼] 13·5	9	9	10	41·5
	Yandilla King	[66¼] 13·5	10	10	10	43·5
						214.0
	Hard Federation	[65¼] 12 5	10	10	10	42·5
	Minister ...	[66½] 13·5	10	10	10	43·5
6752	Prelude ...	[67¾] 14·5	10	10	10	44·5
	Pusa No. 4 ...	[67¾] 14·5	10	10	10	44·5
	Pusa No. 107 ...	[68] 15	10	10	10	45·0
						220·0

Awards.

Class 1022— Macaroni.	First Prize, No. 6684—M. J. D'Arcy; Huguenot; grown at Berrigan on loam; clay subsoil; seed per acre, 45 lb.; yield per acre, 17 bushels; rainfall during growth, 11·50 inches; fallow. Second Prize (divided), No. 6685—M. J. D'Arcy; Indian Runner; grown at Berrigan, on loam; clay subsoil; seed per acre, 45 lb.; yield per acre, 21 bushels; rainfall during growth, 11·50 inches; fallow. Second Prize (divided), No. 6687—M. J. D'Arcy; Velvet Don: grown at Berrigan, on loam; clay subsoil; seed per acre, 45lb.; yield per acre, 16½ bushels; rainfall during growth, 11·50 inches; fallow.
Class 1023— Strong Flour, Red.	First Prize, No. 6694—S. Pollock; Cedar; grown at Quirindi, on red soil; seed per acre, 45 lb.; yield per acre, 20 bushels; rainfall during growth, 15·12 inches; autumn ploughing. Second Prize, No. 6693—A. R. Michael; Cedar; grown at Woomelang, Victoria, on sandy loam; seed per acre, 45 lb.; yield per acre, 9 bushels; rainfall during growth, 9·30 inches: fallow.
Class 1024— Strong Flour, White.	First Prize, No. 6701—S. Pollock; Bobs; grown at Quirindi, on black soil; seed per acre, 45 lb.; yield per acre, 20 bushels; rainfall during growth, 15·12 inches; autumn ploughing. Second Prize (divided), No. 6698—D. and J. Gagie; Comeback; grown at West Wyalong; clay soil; seed per acre, 60 lb.; yield per acre, 18 bushels; rainfall during growth, 10·14 inches; fallow. Second Prize (divided), No. 6706: York Bros., Ltd.; Comeback; grown at Quirindi, on shallow red loam; clay subsoil; seed per acre, 45 lb.; yield per acre, 36 bushels; rainfall, 15·50 inches; autumn ploughing.
Class 1025— Medium Strong Flour.	First Prize, No. 6713—A. R. Michael: Florence; grown at Woomelang, Victoria; sandy loam; seed per acre, 45 lb.; yield per acre, 10 bushels; rainfall during growth, 9·30 inches; fallow. Second Prize, No. 6719—W. H. Scholz; Florence; grown at Gilgandra, sandy loam; seed per acre, 45 lb.; yield per acre, 21 bushels; rainfall during growth, 26 inches; autumn ploughing.
Class 1028— Federation Special.	No. 6726—R. J. D'Arcy; Federation; grown at Berrigan; loamy soil; seed per acre, 40 lb.; yield per acre, 23 bushels; rainfall during growth, 11·50 inches; fallow.
Class 1029— Hard Federation Special	No. 6729—T. Bragg; Hard Federation; grown at Mungeribar, on sandy loam; seed per acre, 45 lb.; yield per acre, 30 bushels; rainfall during growth, 12·84 inches; autumn ploughing.
Class 1030— Weak Flour.	First Prize, No. 6743—S. Pollock; Petatz Surprise; grown at Quirindi, on black soil; seed per acre, 45 lb.; yield per acre, 26 bushels; rainfall during growth, 15·12 inches; autumn ploughing. Second Prize, No. 6739—D. and J. Gagie; Gresley; grown at West Wyalong; seed per acre, 45 lb.; yield per acre, 27 bushels; rainfall during growth, 11·10 inches; fallow.

AWARDS—*continued.*

Class 1031— Five Farrer Wheats.	First Prize, No. 6745—M. J. D'Arcy, Berrigan; grown on loam; clay subsoil; seed per acre—Comeback, Cedar, Cleveland, Federation, 45 lb.; Florence, 50 lb.; yields per acre—Comeback, 27 bushels; Cedar, 20 bushels; Cleveland, 30 bushels; Federation and Florence, 25 bushels; rainfall during growth, 11·50 inches; fallow. Second Prize, No. 6746—S. Pollock, Quirindi; Comeback, Rymer, and Bobs on black soil; Cedar and Canberra on red soil; seed per acre, 45 lb.; yields per acre—Comeback, 28 bushels; Cedar and Bobs, 20 bushels; Canberra, 36 bushels; Rymer, 29 bushels: rainfall during growth, 15·12 inches; autumn ploughing.
Class 1032— Five non-Farrer Wheats.	No. 6752—W. H. Scholz, Gilgandra; grown on sandy loam; seed per acre, 45 lb.; yield per acre, Pusa No. 4 and Pusa No. 107, 17 bushels; Prelude, 18 bushels; Hard Federation, 30 bushels; Minister, 26 bushels; rainfall during growth, 26 inches; autumn ploughing.

THE TOLL OF DISEASE.

"THE toll exacted by plant diseases is appalling. It is estimated by the Department that in 1919 field diseases were responsible for the loss of approximately 190,000,000 bushels of wheat, of 78,000,000 bushels of oats, of 200,000,000 bushels of corn, of 86,000,000 bushels of potatoes, of 58,000,000 bushels of sweet potatoes, of 18,000,000 bushels of apples, and of 1,742,000 bales of cotton. The cost of producing diseased and healthy crops up to the time of harvest is practically the same, so it is clear that plant diseases are a grievous and dangerous overload on our agriculture."

The above is extracted from a recent issue of the *Weekly News Letter*, issued by the United States Department of Agriculture. The article goes on to recite that the Department is making an effort "to reduce the tremendous losses from wheat rust, aggregating in some years as much as 200,000,000 bushels." Scientific investigation has proved that the fungus that is responsible for the disease in the United States gets its start in the spring on the common barberry plant, and a characteristically vigorous campaign is now being conducted against that plant. More than 4,500,000 barberry plants have been located, and the great bulk of them has been destroyed.

SOUTH AFRICAN EXPENDITURE ON PROGRESSIVE AGRICULTURE.

THE following provision has been granted by Parliament of the Union of South Africa for the Department of Agriculture during the year 1921-22, viz., agriculture, £745,861; agriculture (education), £158,316; total, £904,177. This includes provision for an establishment of 1674 and 180 respectively, but "free services," such, for instance, as the printing of the *Journal* by the Government Printer, are not included in the above amount, nor does it contain the provision for such adjustments, in accordance with the recommendations of the Public Service Commission of Inquiry, to salaries as may become necessary during the year. Against this expenditure, it is estimated that departmental receipts for the year will amount to £243,000.—*Journal of the Department of Agriculture, Union of South Africa.*

Sheep-maggot Flies and their Parasites.

Observations made during the Investigations carried out at the Government Sheep-fly Experiment Station, Warrah, 1920–21.

W. W. FROGGATT, F.L.S., Government Entomologist.

THE interest taken by sheepowners in the question of using hymenopterous parasites in the destruction of sheep-maggot flies has spread into all countries where these stock pests are found. Our experience dates back to 19th November, 1913, when we discovered the chalcid parasite (*Nasonia brevicornis*) at Yarrawin, near Brewarrina, in the pupæ of *Calliphora rufifaces*. known as the hairy maggot fly. Artificial propagation was at once undertaken, the species identified, and the life history and habits recorded in this *Gazette*.

A fly aviary was erected at the Koorogamma Sheep-fly Experiment Station, Moree, at the request of the Pastoralists' Committee, and a regular supply of livers was obtained from local butchers for the development of fly maggots for parasitic infestation. Before this experiment station was closed down many millions of parasitised pupæ had been sent all over Australia, and even to New Zealand and Tasmania.

The methods adopted have been fully explained in Farmers' Bulletin No. 122 ("Sheep-maggot Flies, No. 4,") and an important paper entitled "The Economic Study of *Nasonia brevicornis*, a hymenopterous parasite of *Muscoid Diptera*." was contributed to the *Bulletin of Entomological Research* (Vol. ix. 1919. London), by John L. Froggatt, B.Sc.

During this work the list of sheep-owners asking for consignments of parasites increased so rapidly that we had 550 names down before we left Moree. The work reached such magnitude that, at a meeting of the Pastoralists' Sheep-fly Committee in July, 1919, it was decided that this branch of our work should be separated from that of the field work of the experiment station, and a sum of £100 was voted to erect a suitable building near Sydney to be devoted to parasitic work. After inspecting several sites it was decided to accept one offered by the Under Secretary at the Veterinary Station at Glenfield.

The buildings constructed consist of a small weatherboard laboratory fitted with shelves to hold the specially-constructed breeding cages in which the blow-fly pupæ are placed, and where they are parasitised by the chalcid wasps. Besides this there is the fly aviary, which has the upper portion of the walls enclosed with wire netting to allow for the free entry and exit of the

blow-flies. On the surrounding benches are placed a number of shallow wooden boxes, half-full of clean dry sand, on which is placed half a bullocks' liver, which is soon blown by flies attracted from the surrounding bush. The resultant maggots remain in and under the liver until fully fed, when they bury themselves in the sand and develop into pupæ. As soon as this happens these pupæ are sifted from the sand, dried, and removed to the breeding cages in the adjacent laboratory, where the final act of parasitisation takes place.

There was some doubt when we started operations whether there would be sufficient blow-flies in the neighbourhood to supply maggots for the parasites all the year round. This fear has proved groundless. During last year we had the whole place infested every month in the year, winter and summer, although during midwinter the maggots grow very slowly and take a long time to pupate, while the parasites remain dormant in the fly chrysolid for a much longer period than in warmer months. Mr. James McDonald, who was in charge of the work during the latter part of our stay in Moree, was placed in charge of the new insectarium. Every Wednesday morning he brings the pupæ parasitised during the previous week to the entomological laboratory, Sydney, where they are packed and dispatched to sheepowners, either direct or through the stock inspector. An average of twenty-five to thirty postal blocks (wooden cylinders with a lid), containing each about 1,000 parasitised fly pupæ, are posted every week. With each package a typed leaflet is enclosed to inform the recipient how to treat and spread the parasites.

As many sheepowners signify their intention of taking up the artificial breeding of parasites on their own account, a second leaflet has been prepared, and is sent to such inquirers, and now a number of pastoralists are breeding parasites on their own account. We have over 800 names of sheepowners on our register who have been supplied with packages of parasites, some of them with three or four consignments.

A third leaflet is often sent to pastoralists known to be interested in parasites. This leaflet requests them to forward information as to their own observations in the establishment and spread of the parasite in their district.

The question has been raised by economic entomologists and others as to the original home of the chalcid wasp (*Nasonia brevicornis*). Some claim that if it is a native of Australia, and has always been here with the indigenous flies, its value as an effective parasite is less than would be that of a similar introduced wasp from a different country, and they have been advocating the introduction of new and untried hymenoptera, which have been chiefly bred from house flies, and several of which are known to destroy useful insects.

Though *Nasonia brevicornis* has been found under natural conditions in very distinct areas far inland where it would be somewhat difficult for it to have been accidentally introduced, we have no proof that it is indigenous to Australia, or that it has been here for any extended period. It was

originally bred from the pupæ of the common house fly (*Musca domestica*) at Urbania, Illinois, U.S.A.; it has been described from the same host in Chili; specimens have been received at the British Museum from India, and it has been found infesting the pupæ of house flies in the Zoological Gardens at London.

Wherever it originally came from it is primarily a parasite of *Musca domestica*, a house-haunting fly with a world-wide range, and we may suggest that by being carried outside the range of this fly it has had to attack the pupæ of the larger flies. In every record we have of this parasite being found in the paddocks it has been found in the pupæ of the hairy maggot fly, first known as *Calliphora rufifaces*, but now determined by Major Patton as *Chrysomyia albiceps*, a cosmopolitan blow-fly common in India and ranging over a large area. *Chrysomyia albiceps* is the most deadly and persistent among all blow-flies in blowing live wool, and it is responsible for nearly all infestation in the summer months.

The chalcid parasite (*Nasonia brevicornis*) hibernates through the winter months under the same conditions as the blow-fly, and emerges at the same time on the advent of warm weather. We have found no hyper-parasites destroying it, and it has only been obtained from the pupæ of injurious muscoid flies. If there be any effective chalcid parasite that is going to assist in controlling the destructive sheep-maggot flies it is *Nasonia brevicornis*.

In a recent report published by the Queensland Sheep-fly Committee, Mr. Russell, of Dalmally, who is doing valuable work in sheep-fly control near Roma, is credited with saying, "My contention is that the chalcid wasp will not exterminate the fly or control it below a point that is harmless to the sheep. When the fly is normal . . . . . . the chalcid destroys about 25 per cent. of the pupæ of the fly, sometimes less." Now, no entomologist or student of nature's laws has ever claimed that any parasite can *exterminate* its host. It is only one of the weapons with which we can fight a pest, and it is gratifying to find such an authority as Mr. Russell making such a statement. It has been estimated that the loss to Australian sheepowners from sheep-fly infestation annually is over £2,000,000. If *Nasonia brevicornis* can, as Mr. Russell states, prevent 25 per cent. of this damage, then our tiny little friend is saving Australia £500,000 annually.

The Swollen-legged Chalcid (*Chalcis calliphoræ*, Froggatt).

This is a very interesting parasite, because nearly all the members of the group lay their eggs in the bodies of moth or butterfly larvæ (caterpillars) before they pupate. Its hind legs are furnished with processes that enable it to cling to the squirming larva as it inserts its ovipositor and deposits a single egg beneath the caterpillar's skin. In this case the chalcid deposits her egg in the body of the blow-fly maggot. This parasite was first recorded at the Sheep-fly Experiment Station at Hay, and was described and figured in the *Agricultural Gazette* in July, 1916.

It has since been bred under similar conditions at Moree and at the Glenfield insectarium, and specimens have been received from North Queensland.

The Slender-bodied Chalcid (*Hemilexomyia abrupta,* Dodd).

This handsome little wasp was figured and described, but not named in Farmers' Bulletin, No. 113 ("Sheep-maggot Flies, No. 3"). It was defined as the third hymenopterous parasite found at Wooloondool. On 12th August, 1916, several were found in a breeding jar where there were a number of the pupæ of the shining black fly, *Ophyra nigra*. It was obtained at Moree from the pupæ of *Calliphora villosa.* Mr. Wilson sent specimens bred from blow-fly pupæ at Marsden's, and I captured a single specimen sweeping the grass with a net at Grenfell. At the insectarium at Glenfield Experiment Station it is often found trying to get through the hessian covers over the liver boxes in which the fly maggots are feeding. When they get on to the squirming maggots they turn backwards, pressing the maggot on to the liver or sand with the tip of their abdomen, and apparently depositing the egg at the same time. Unlike most wasp parasites, they crawl over and among the putrid and decaying matter without any fear of soiling their wings.

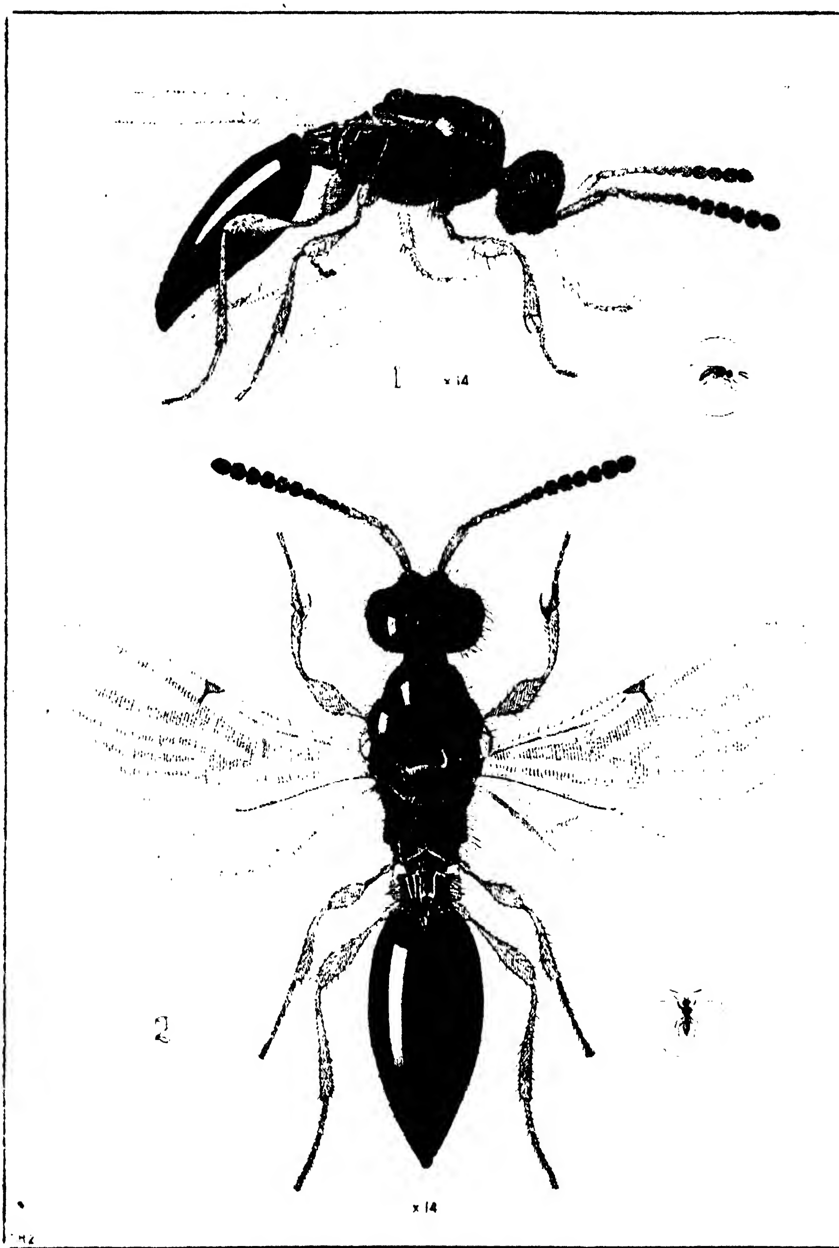
Mr. Alan P. Dodd has recently described and named this proctotrypid wasp in *Proceedings of the Linnean Society of New South Wales* (Vol. xlv, p. 3, p. 444, 1920), placing it in the family *Diapriidæ*, and creating a new genus for its reception.

The Red-legged Chalcid (*Stenosterys fulvoventralis* n.sp., Dodd).*

Large numbers of this little parasite were found on the windows of the insectarium at Glenfield when we first started breeding out chalcid wasps, and identical specimens have since been received from Queensland. It measures about 3 mm. in length. Head, upper surface of thorax, and upper and under surface of abdomen dull black with metallic reflections, brightest on the hind portion of the thorax. Antennæ, with the scape and first joint reddish-yellow, the rest (three to eight) dark chocolate brown, thickly clothed with fine short white hairs. Legs, under surface of the abdomen, reddish-brown when alive, but dull yellowish-brown in dead specimens. Legs clothed with dull yellow hairs, darkest at the tips of the tarsi. Face, back of head, and dorsal surface of the thorax bearing scattered, rather long, black hairs. Wings transparent, nervures brown, fore pair covered with very fine, short black hairs, hind pair finely crenulated and iridescent.

This parasite laid a single egg in the fly pupæ as far as we could ascertain, and at first it seemed that it might become a serious check on the breeding of *Nasonia brevicornis* by becoming a hyper-parasite upon it, but it disappeared as suddenly as it had appeared, and only odd specimens have been seen at the insectarium during this last six months. Mr. Alan P. Dodd, to

* This species is identical, I believe, with the species recently described by Professor Harvey Johnston and Mr. O. W. Tiegs in *Proceedings of the Royal Society of Queensland,* vol. xxxiii, page 118, 1921, under the name of *Australencyrtus giraulti.*



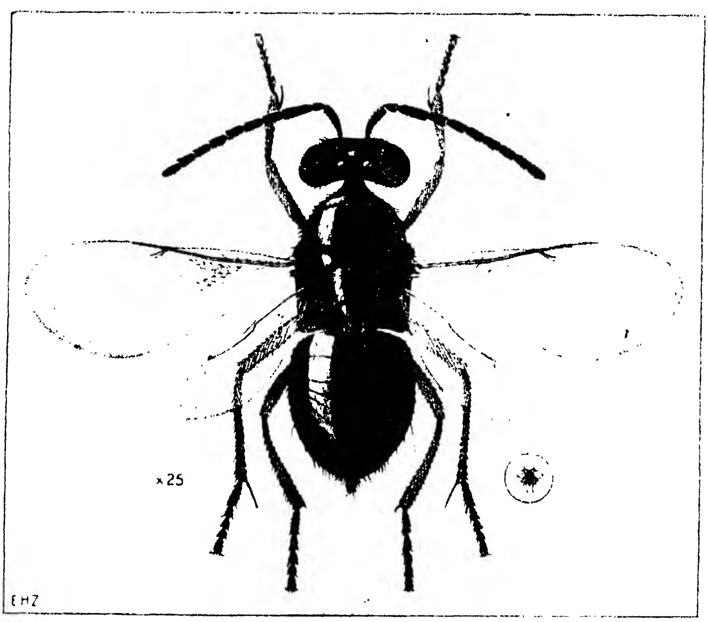
The Slender-bodied Chalcid (*Hemilexomyia abrupta* Dodd).

1. Side View. 2. Dorsal View.

whom I sent specimens, states that it is a new species of the genus *Stenosterys*, of the family *Encyrtidæ* (tribe *Ectromoni*), and he has sent me the following technical description :—

Technical Description.—Female, length 2 m.m. Dull metallic purplish-black, the scutellum toward apex bright green, the sides and venter of the meso- and meta-thorax bright orange-yellow, the propodeum dull yellow; legs wholly orange-yellow, including the coxæ; mandibles orange-yellow; antennæ black, the scape yellow.

Head normal, the vertex not long, the vertex and face gently inflexed; viewed from in front sub-circular, the clypeus emarginate; frons very broad; surface finely, densely scaly, with a few scattered punctures; ocelli large, equidistant, the lateral pair separated from the eye margins by their own diameter; eyes bare, moderately large, but no longer than their distance from the mouth border; mandibles strong, bidentate, the teeth acute and nearly equal; antennæ inserted on a level with ventral ends of eyes and well above the clypeus, widely separated by a raised obtuse hump; antennal scrobes moderately long. Antennæ twelve-jointed, with one short ring joint; scape long and slender; pedicel and flagellar joints with dense stiff hairs or bristles; pedicel about twice as long as its greatest width; flagellum cylindrical; funicle one very slightly longer than the pedicel, one-half longer than two; two to six gradually shortening, six a little wider than long; club not enlarged, three-jointed, not as long as the three preceding joints united, the joints about sub-equal. Thorax normal; pronotum short; scutum large, densely scaly and with a number of stiff black bristles; axillæ meeting at base of scutellum and separated only by a short carina; scutellum long, reaching almost to posterior border of thorax, scaly at base, becoming smooth and polished toward apex, its surface with a few scattered bristles; propodeum short, finely scaly. Forewings very long, extending well beyond apex of abdomen, broad, subhyaline; an obscure oblique hairless line is present, and proximad of this the discal cilia are coarser and are arranged in several irregular rows; venation thick, fuscous; costal cell wide; submarginal vein joining the costa a little before middle of wing; marginal vein not punctiform, fully three times as long as its width, about subequal to the postmarginal, and slightly shorter than the curved stigmal vein. Legs normal, slender, the posterior tibiæ with two unequal apical spurs. Abdomen short, broad, the ovipositor valves hidden.



(*Stenosterys fulvoventralis* Dodd).

Male.—Very similar to the female. Antennæ with seven funicle joints and a solid club; scape rather stout; pedicel short, very little longer than its greatest width; funicle one three times as long as wide, about one-half longer than two; two to seven very slightly shortening; club a little longer than preceding joint.

Described from five females, four males, labelled "Glenfield, N.S.W., from sheep-fly insectarium, 20th January, 1920," also "From sheep-fly puparia, Glenfield, N.S.W., 22nd January, 1920, W.W.F." Mr. Froggatt writes that he has seen specimens from Queensland.

Type.—In the collection of Mr. W. W. Froggatt.

Cotypes.—In the collections of W. W. Froggatt and A. P. Dodd.

In Ashmead's table (1904) this species falls into *Stenosterys*, Thomson, and agrees in general with the given diagnosis of that genus. In Girault's table (1915) it best falls near *Leptomastix*, Foerster, and *Stenosterys*; the members of the former genus, however, have much longer antennæ than the species before me. The generic characters agree remarkably well with those given for *Parectromoides*, Girault, except that in that genus the frons is stated to be "moderately narrow," whereas in this case it is obviously broad.

(To be continued.)

An Experiment in Selection.

The value of systematic selection is instanced by the results of an experiment recently carried out by members of the Springside branch of the Agricultural Bureau in collaboration with the Department of Agriculture. Thirteen selections were planted, all except two of these being made simply on the appearance of the tubers, and the two exceptions comprising second-growth tubers broken from large potatoes. The advantages claimed for this type of seed were that the tubers were immature and were the progeny of potatoes of strong vitality—both of which are essential points in the reproductive quality of seed potatoes.

This argument the results amply justified. The two highest yields were obtained from the second-growth immature seed, the winning yield being at the rate of 4 tons per acre. The best yield obtained from seed selected by growers from their ordinary stock only totalled 2 tons 9 cwt. An intermediate yield of 3 tons 7 cwt. was obtained from ordinary stock, but in this case the parent seed had been selected in the same manner as that in the two winning plots.—A. J. Pinn, Inspector of Agriculture.

Newly Recorded Weeds.

Two exotic caryophyllaceous plants, new for the State, have been recorded at the National Herbarium, Sydney.

Saponaria Calabrica, Guss., from the hill opposite Cave House, Jenolan Caves (W. F. Blakely, Oct., 1899). Mr. J. Wilson, who for a number of years was proprietor of the Cave House, expressed the opinion that it was introduced in foreign chaff that he brought to the Caves.

Silene noctiflora, L. "Night Silence or Clammy Cockle." Ulong near Coramba (W. Heron, Feb., 1913). This plant is said to be a native of Sweden and Germany, but it is now a cosmopolitan weed. In various parts of the United States it is a pest in agricultural areas, and its seeds sometimes form one of the impurities of lucerne seed.—W. F. Blakely, National Herbarium, Botanic Gardens.

A Friesian Cow's Thirty Days' Yield.

During the month of June, the Friesian cow, Woodcrest Johanna Tehee (imp.), owned by Mr. Eric Lloyd Jones, of Lydholme, Bundanoon, New South Wales, was subjected to a special test over a thirty days' period, commencing on 28th May and ending 26th June

The testing was carried out under the United Pure Bred Dairy Cattle Breeders' Association, the cow having been entered for the official test over 273 days, but the usual practice was varied by making an additional test midway between the one taken on 28th May and that on 26th June. The results of Woodcrest Johanna Tehee's test are as follows:—

	First Test.			Second Test.			Third Test.		
	Morning.	Noon.	Evening.	Morning.	Noon.	Evening.	Morning.	Noon.	Evening.
Milk ... ... lb.	33	33½	25½	38	31½	29	33	28½	29
Test ... per cent.	3·2	3·0	3·5	3·4	3·4	3·4	3·0	3·2	3·2
Butter-fat ... lb.	1·056	1·005	·8925	1·292	1·071	·986	·990	·912	·928
Total Milk ... lb.	92			98½			90½		
Total Butter-fat ,,	2·9535			3·349			2·830		

Averaging the records of the first and second test, and those again of the second and third, the average per day for the two subdivisions of the thirty-day period is:—

First sub-period	...	95·25 lb. milk	3·151 lb. fat
Second ,,	...	94·50 lb. ,,	3·09 lb. ,,

This works out at 2,848½ lb. milk, 93·798 lb. butter-fat, for the thirty days, the average test being 3·292 per cent.

The record made in 1919 by the Guernsey Tulip des Pres for the same period was 2,075·63 lb. milk, 102·36 lb. butter-fat, the average test being 4·93 per cent.

It will be seen that the Friesian has exceeded this, as far as milk is concerned, by about 773 lb., but the Guernsey leads on butter-fat production by 8·56 lb.

Woodcrest Johanna Tehee was fed as follows while putting up this record:—

28th May, 1921: Pasture—natural grasses, oats and peas short; 45 lb. swedes, 15 lb. hay, 20 lb. of a mixture of bran, oil meal, oats and corn meal, 8 lb. ensilage daily.

14th June, 1921: Pasture—oats for about six hours; 6 lb. ground maize, 6 lb. crushed oats, 5 lb. linseed meal, 5 lb. bran, 15 lb. ensilage, 50 lb. sliced turnips, 25 lb. lucerne hay.

26th June, 1921: Natural pasture; ensilage 20 lb., bran 4 lb. (approx.)

The champion producing cow of all breeds is the Friesian Segis Pieterje Prospect, whose record for 365 days was 37,384 lb. milk, 1,158·95 lb. butter-fat, with an average test of 3·073 per cent., equal to an average yield per day over the whole year of 102·4 lb. milk, 3·18 lb. butter-fat.—L. T. MacInnes, Dairy Expert.

Cheesemaking on the Farm.

[Continued from page 657.]

J. G. McMILLAN, M.B.D.F.A., N.D.D.

The Composition of Milk.

MILK is chemically described as a secretion of the mammary glands of the female mammal. Cheese is made from the milk of several animals—the cow, goat, sheep and mare, but in this country that of the first-mentioned animal only is used for the purpose.

Cow's milk contains very many different substances, which are generally put under the following six headings:—Water, 87·2 per cent.; fat, 3·9 per cent.; casein, 3 per cent.; albumin, ·45 per cent.; milk sugar, 4·7 per cent.; mineral matter, ·75 per cent. Total, 100 per cent. When a measured quantity of milk is evaporated to dryness, the portion remaining is termed the total solids; this residue is again divided into two headings, namely, solids fat and non-fat. In the above quoted analysis the fatty solids would represent 3·9 per cent., and the non-fatty, 8·9 per cent. of the whole milk. The amount of solid matter in milk varies according to the breed of the animal, the period of lactation, feed, health, climatic conditions, &c.

Jersey and Guernsey cows give the richest milk and the Friesians the lowest in fat percentage. The fat percentage is lower in the early period of lactation than toward the end. Feeding plays an important part in the quality of the milk secreted; and where cows are grazed on succulent pastures they give a higher yield of milk, but of poorer quality, than when feed is drier, though these statements must be regarded as general rules, subject sometimes to reversion.

The Water Content.—This is pure water and can only be separated from the solids by evaporation. It is necessary for the production of dairy products and forms about 30 per cent. of ripened cheese. These facts illustrate how essential it is that cows should have a supply of pure drinking water.

Fat.—Butter-fat is made up of about ten different fats, some of which are volatile and others non-volatile. The volatile form about 10 per cent. of the total fats, and it is the presence of these volatile fats that allows the chemist to differentiate between butter and margarine, and which gives butter its particular flavour. Butter-fat exists in the form of small globules which can only be discerned by means of the microscope. It is yellow in colour, varying according to the breed of the animal and the class of food consumed. Green pastures will produce a fat of higher colour than a dry food. Fat is a very necessary constituent to the production of a rich cheese.

and it is the general practice now to pay for milk at cheese factories on the fat content. We know that a milk containing 4·5 per cent. fat will not produce half as much again of cheese as a milk with 3 per cent. fat, but the quality will be better and the cheese should bring a higher price.

Casein.—Although fat is the most valuable constituent of cheese, the essential constituent is casein, which is coagulated by rennet effecting the envelopment in its meshes of the fats, as well as small portions of the other constituents. Casein can also be coagulated by the use of weak acids such as hydrochloric and lactic acids, but not by heat. For cheesemaking, however, coagulation with acids is unsuitable. Being of a highly nitrogenous nature, casein is a most valuable food. It is now prepared in large quantities and used in the manufacture of varnishes, knife-handles, buttons, &c.

Albumin.—Albumin is also rich in nitrogen; it differs from casein in that it is coagulated by heat, but not by acids. It is of absolutely no use in cheesemaking, and being in solution passes away in the whey. The milk for the first few days after a cow calves contains a high percentage of albumin, and should never be added to the rest of the milk in the cheese vat until it will withstand a temperature of at least 180 deg. Fah. without showing coagulation.

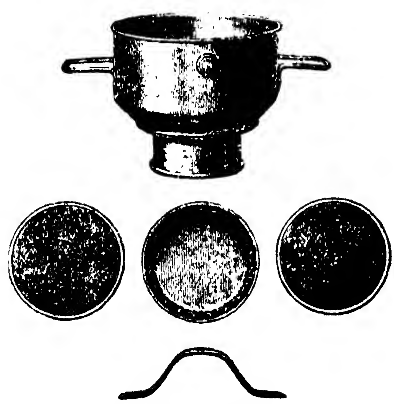


Fig. 5.—Milk Strainer.

In this strainer a piece of lint is used, being held in position between two pieces of brass gauze, all kept in place by a spring clip.

(*After Tisdale and Woodnutt.*)

Milk Sugar, or Lactose.—Milk sugar occurs in a state of solution. It is the first constituent of milk to undergo decomposition. It is a necessary constituent in the process of cheesemaking, particularly during the manufacturing stage; from it, by a process of bacterial decomposition playing an important part in the production of flavour and texture, is produced lactic acid. In some countries lactose is obtained from the whey on a large scale by special process, and is used for the standardising of certain milk foods for infants, also in the preparation of medicines. It is mainly the presence of lactose that makes whey a valuable food for calves and pigs.

Ash.—Ash (sometimes referred to as mineral matter) contains many chemical substances, such as lime salts, which are essential to the formation of a good, firm curd. Lime occurs both in a soluble and insoluble condition. When milk has been heated to a very high temperature these soluble salts are rendered insoluble, and thus the action of rennet in milk that has been subjected to a temperature of over 160 deg. Fah. is retarded or

entirely hindered. Certain chemicals can be added which to a great extent restore coagulability, but it is not advisable at any time to heat milk above 160 deg. Fah.

The Care of Milk.

The first essential to the production of good cheese is to have a sound and clean raw product. When milk is first drawn from the cow, except for the first few drops and provided the udder is in a healthy state, it is practically sterile—that is, it is free from bacterial life—but as the atmosphere about the cow-bails teems with bacteria, and as newly-drawn milk constitutes an ideal food at a temperature suitable for bacterial development, it soon becomes contaminated. It is only a little over thirty years since the cause of milk going sour was discovered, and the trouble traced to bacteria so small that 200 can be placed on the point of a pin. There are now known to scientists 200 different kinds of bacteria, each of which plays some part in the life and decay of both animal and vegetable matter; and just as there are bacteria which are antagonistic to human life, there are those without the presence of which human life is impossible. Food, moisture, and suitable temperatures are necessary for their existence. For the development of some the presence of air is necessary, while to others air is detrimental. Under favourable conditions bacteria reproduce at a rapid rate, one germ being able to increase to 16,000,000 in twenty-four hours. Luckily for mankind, bacteria cannot go on producing continually, their development being checked by the very substances they produce. For example, the bacteria which convert milk sugar into lactic acid become dormant when they have converted about a quarter of the lactose into acid. Another organism begins work on the casein, but they in turn stop work at a certain stage. And so does the decomposition proceed until the milk is converted into a putrid mass.

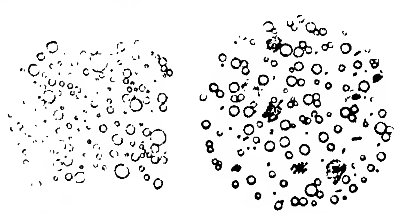


Fig. 6.—Appearance of Milk under the Microscope.

On the left, well-strained milk; only fat globules are seen. On the right, unclean milk; the light round bodies are fat globules, and the dark masses are groups of bacteria and cellular matter.

(After van Slyke.)

Different kinds of bacteria flourish at different temperatures, called the optimum point. These temperatures range from 70 to 90 deg. Fah., though in isolated cases they are higher or lower. Bacteria cannot live in intense heat or cold, in chemically preserved milk, or in strong sunlight. Some species of germs are beneficial and necessary in the manufacture of cheese and are specially cultivated, but certain others are responsible for many of the bad taints found. The cheesemaker's object is to assist in the development of the useful kinds of bacteria and to keep the milk as free as possible from the undesirable ones. This is done in several ways—by cooling the milk to a low temperature (60 to 70 deg. Fah., if practicable) as soon as possible after it is drawn, by keeping the milk in a pure atmosphere, and by using cultures of

the desirable organisms for the development of acid. Heating milk momentarily to 160 deg. Fah. (a process called pasteurisation) kills almost all the active organisms, but as certain kinds of bacteria produce spores or eggs which are not destroyed by pasteurisation temperatures, it is necessary, if the destruction of these bacteria is desired, to subject milk to very high temperatures for a considerable period. This process is termed sterilisation. If stored in hermetically sealed receptacles, sterilised milk will keep indefinitely. It cannot be used, however, in the manufacture of dairy products, on account of the chemical changes effected by sterilisation producing objectionable flavours. Thus, for all practical purposes of improving the keeping qualities of milk and cream, pasteurisation is adopted, not sterilisation.

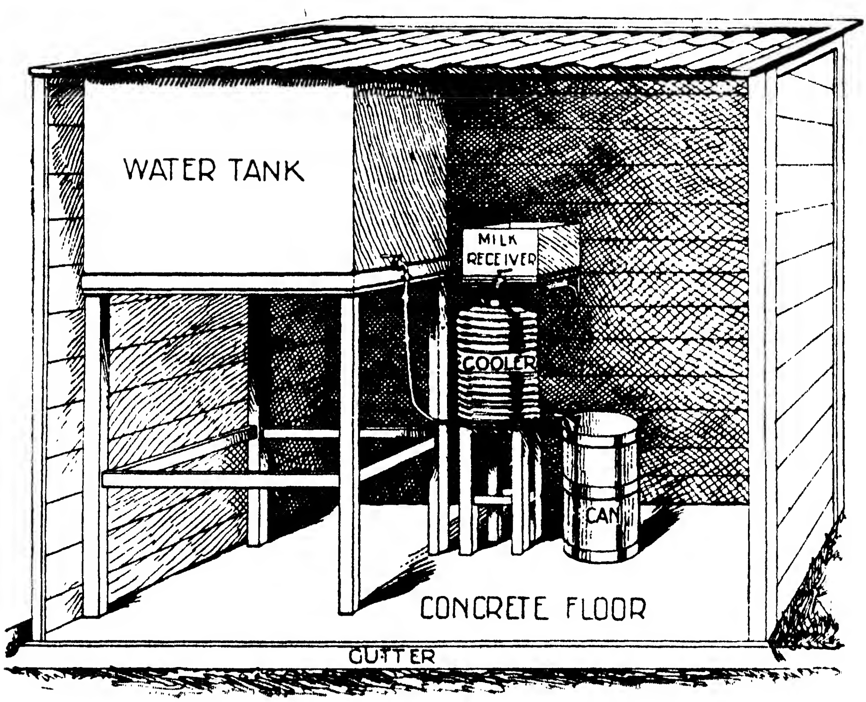


Fig. 7.—Milk-house and Cooling apparatus.

As we have already seen, bacteria readily find their way into milk; therefore it is necessary to remove the lacteal fluid as rapidly as possible from badly infested environments to those that are purer. The practice of having milk-cans in close proximity to the cows is bad. After each cow is milked the bucket should be emptied into cans or other receptacles kept in a separate shed, to assist in reducing the bacterial content of the milk, and lessen the danger of absorption of bad odours. Theoretically, the further the separate shed is from the cow-shed the better, but in actual practice it is necessary that the two sheds should be reasonably close together.

The Correct Procedure in Milking.

The cow having been bailed or tied up, the milker should wipe the udder with a damp cloth; this is preferable to brushing, which only causes the dirt to float in the atmosphere and subsequently to drop into the milk bucket. A separate cloth should be used by each milker and should be kept thoroughly clean and sweet—a smelling cloth is a source of contamination. Where gravitation water is not available, a good plan is to have, say, two oil-drums into each of which is fixed a small tap. These drums should be fixed to the posts or walls and filled up with water, a system thus being installed that allows the milker to have clean water in which to wash his or her hands. Very often one finds basins of water used, but as this is probably not changed during the whole milking operation it becomes a thick soup containing myriads of organisms, and therefore a source of contamination instead of benefit. After the milking of each cow the milker should wash his hands in clean water and dry them; if this is not done there may be bacteria in the liquid on the hands that will gain access to the milk in the bucket. Dry milking *versus* wet milking is often a debated point, but the practice of drawing a little milk into the bucket and dipping the fingers therein is undoubtedly most insanitary. A good plan is to touch each teat with a little vaseline, which prevents friction and also prevents cracks on the teats.

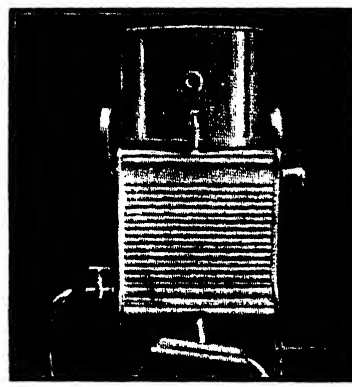


Fig. 8.—Cooling apparatus suitable for dairy where cheese is made.
Such an apparatus allows of newly drawn milk being cooled direct into the vat.
(After Tisdale and Woodnutt.)

The foregoing simple rules for hygienic milking have been preached by the Department of Agriculture for years, but unfortunately there are still few dairymen who observe them. It is unnecessary to defend washing on the score that any time expended on it is subsequently made up, for even if the time were actually time lost its expenditure would still be very well worth while. The writer, however, most deliberately counters that most common argument against this habit of elementary cleanliness—that it takes up time. He contends that any time occupied in washing the hands is made up eventually by reason of the water's stimulating effect on the hands of the milker. As a shower invigorates the tired body, so does a wash invigorate the milker's tired hands and wrists. Supposing that fifteen seconds is taken up in washing the milker's hands and the udder in the case of each cow, and that one milker milks sixteen cows at a sitting, this would mean a total loss of about four minutes, and the increased speed of milking would easily make up this time. Moreover, as every dairyman knows, the more actively the milking is done the more the activity of the milk-secreting cells is stimulated, hence more milk of better quality. Balance up these

arguments for and against dirty milking, Mr. Dairyman, putting on the side of cleanliness its other advantages (such as its tendency to lessen the risk of transmitting disease from cow to cow), and you will see that clean water for washing should have an honorable place in the dairy.

Dairymen who milk with dirty hands often black with manure, should consider the effects their slovenliness might have, not only on dairy products, but on their fellow beings. Often this carelessness is due not to lack of personal cleanliness, but to want of knowledge of bacterial life. If every dairyman would only take a fortnight's instruction in bacteriology the beneficial effect on our dairy produce would be marked. Let every dairyman have a look at his hands when dirty and ask himself if he would like to

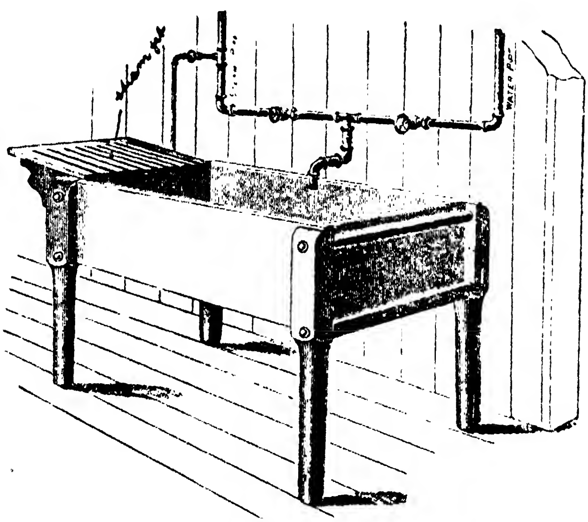


Fig. 9.—A wash-up tub on the verandah of a dairy.

(*After Decker.*)

see the baker from whom he buys his bread kneading his dough with hands in similar condition. He would say that such a baker was a dirty person. Yet bread is subjected to a temperature in the oven high enough to kill the organisms, whilst milk is generally consumed in the raw state. With which, then, of the two main foods we have should the greatest care be taken ? Not only should every process in connection with the milk itself be cleanly, but cow-bails should be so constructed as to allow of easy cleansing and should be frequently lime-washed as well as cleaned daily.

After the milk is drawn it should be thoroughly strained into either cans or a vat placed over a pipe-cooler. Various kinds of strainers are in use. Those with one piece of gauze only in the bottom are of little value, as they do not collect small particles of dirt. The best strainer to employ is that

with two gauze strainers, and a piece of lint placed between them. A fresh piece of lint should be used for each milking and the used one destroyed by burning. At a cheese dairy, if four thicknesses of cheese cloth are tied to the bottom of the strainer, good filtration will be effected. It is very necessary, if this method is practised, that the cloth be thoroughly washed and boiled, otherwise it becomes foul and contamination is sure to occur.

It is not possible for the dairyman to obtain sterile milk under practical conditions, but with care he can reduce bacterial development to a minimum by lowering the temperature of the milk as quickly as possible. Cooling is done by setting the milk-cans in water in a concrete tank, running off the water when it approaches the temperature of the milk and replacing it with fresh. One or two stirrings during the evening will also assist wonderfully in keeping the milk cool and fresh. The most efficient method, however, is to have a shed wherein a pipe-cooler can be placed. Water is allowed to gravitate through this, either from a pipe reticulating from a main or from, say, an elevated tank that is supplied from a well. Where water is scarce a tank is placed on a stand, under cover and so high that the water will pass through the cooler. Another tank is placed on a lower level so that the water from the cooler will flow into it, and attached to this lower tank is a semi-rotary pump to elevate again the water to the higher tank. If lime is placed in this water it will assist in keeping it free from bad smells. Instead of cooling in a special shed, the process can be carried out in the making-room the cooler being placed in such a position that when the milk passes over it will go direct into the making-vat.

Using a cooler is preferable to setting the cans of milk in water, because the milk is spread out in thin layers, thus enabling many of the animal and food odours to escape. The running of the morning's milk over the cooler is beneficial also. It is very necessary that this cooling be done in an atmosphere as free from dust as possible, otherwise more harm than good may result. Every means possible should be devised to prevent the ingress of flies during the milking and cooling operations.

The Care of Utensils.

All utensils used in connection with the collecting of milk should be of good quality and free from crevices, rust, &c. Buckets and similar receptacles in one piece are the best. The kerosene tin, so universally used for one purpose and another, is an excellent and useful article, but as a milk utensil it is not to be recommended, owing to the seams being open, thus affording a refuge for organisms. If kerosene or petrol tins are used the seams should always be filled with solder.

After use all utensils should first be washed with either *cold or tepid* water, rinsed, cleansed with hot water containing soda, and finally sterilised with boiling water or steam. If hot water is applied first the albumin is coagulated

and attaches itself to the surface of the tins and is difficult to remove. The temperature of the metal should then be so great as to dry up all moisture, when the utensils are placed on a rack, mouth downward, immediately after being scalded. The use of cloths with which to dry the utensils is not recommended. When set on racks in an inverted position utensils will keep sweet and very little dust will gain access to them. Some dairy people rinse the utensils with cold water after scalding, but this practice is obviously unsound.

Milking Machines.

Heated controversy often occurs on the subject of milking machines. Most managers are against them on the grounds that milk drawn by them is never as good as that drawn by hand, but that this is the fault of the machines must be emphatically denied. It has been proved beyond doubt that where milking machines are kept in a thoroughly clean condition the milk drawn by them has a bacterial content lower than that of hand-drawn milk. Unfortunately, however, milking machines are not properly cleansed—hence the factory managers' complaint. Some agents, in order to sell their machines, will tell the dairyman that very little cleansing is required and that it is never necessary to scald them. But the housewife knows that after she has once put milk into a jug it is necessary to wash and scald the receptacle before a fresh lot is put in, or the contents will go sour; and it should be obvious to any thoughtful dairyman that if a porcelain jug requires frequent scalding, it is still more necessary that rubbers and accessories of similar absorbent nature must be subjected at least as frequently to temperature sufficient to kill harmful organisms, and that otherwise pollution of milk coming into contact with them must occur.

No dairyman should purchase machines unless he has the written guarantee of the agent that the rubbers and inflations will withstand scalding water containing soda without injury. Machines should be thoroughly washed out after each milking, and scalding water should be passed through them, and once a day they should be brushed thoroughly. Rubber tubes and inflations should be kept in lime-water between milkings. Where the releaser system is used the delivery pipe must receive careful attention, and between milkings should be open at each end so as to allow air to pass through. These pipes should be taken down frequently. It is also necessary that boiling water be passed through the vacuum pipe frequently. In this article the writer is not concerned with the merits or demerits of milking machines as a solver of labour problems, but he has no hesitation in stating that if machines are kept scrupulously clean, a better and cleaner milk can be obtained by use of them than by hand-milking.

(*To be continued.*)

Feeding Experiments with Solanum Opacum.

MAX HENRY, M.R.C.V.S., B.V.Sc., AND F. WHITEHOUSE, B.V.Sc.

IN the proceedings of the Linnean Society of New South Wales for the year 1917, appeared "Notes on the common Nightshade (*Solanum nigrum* Linn.), and some closely related forms and species that have been confused with it" by E. Cheel, Botanical Assistant. Following an exhaustive review of the literature on the subject, and the results of his researches, Cheel concluded that *S. nigrum* had not yet been found in Australia; that there were three distinct species or sub-species found in Australia and the Pacific Islands, namely, *S. opacum*, *S. pterocaulon*, and *S. astroites*; and that although the evidence seemed to indicate that some of the plants were harmful, no definite evidence had been furnished as to which of the three species found in Australia were harmful. In the body of his report Cheel drew attention to the necessity of examining each form separately, in order to decide whether any, and if so, which were poisonous.

It may be pointed out that, with the possible exception of Dutton's cattle at Broadmeadows, in Victoria, there is no evidence of scientific value that any of the species are poisonous, but the question obviously required further investigation, and work was therefore undertaken in that direction, *S. opacum* being first dealt with. The berries are reported to have been fed to guinea pigs by Cleland, with negative results, but no feeding of domestic stock has, so far as can be found, been recorded.

The experiments herein detailed were carried out by the authors in two widely separated districts to endeavour to obviate any local differences, and in the months of April, December, and February. Pigs and sheep were the animals used.

Trials with Pigs.

1. A small 4-months-old Berkshire pig, starved for twenty-four hours, was fed 8 ozs. of green berries and an equal quantity of wheat in water. The greater part was eaten without ill result. Next day he was given 5 ozs. of green berries, crushed in a little wheat and water, at 9 a.m. At noon, was suffering from mild diarrhœa, fæces being greenish and liquid. At 1 p.m. was given a drink, being then bright and vigorous, with good appetite. At 4 p.m., given 2 ozs. of berries crushed in wheat and water. All consumed. Diarrhœa cleared up during the night.

2. A stunted 4-months Berkshire pig was fed on *Solanum* plants as follows:—First day, 4 lb. of leaves, stalks and berries. Second day, 10 lb. of leaves, stalks and berries. Pig ate fairly well on both days, receiving no other food. No ill-effects whatever observed.

3. A number of well-grown *Solanum opacum* plants were thrown into about a dozen pigs, and at once eaten with relish. No ill-effects observed.

4. A Yorkshire weaner sow was fed 9 lb. of swill, in which was mixed 3 lb. of chopped plant. All eaten. No ill-effects. This pig was fed daily as above for a further fortnight. The result was negative.

5. A sow of the same litter received 9lb. of swill in which was mixed 1lb. of berries. All eaten—negative result.

6. A 2½-months middle Yorkshire boar drenched with a decoction of ⅜lb. of plant, and another with a decoction of ¼lb. of berries—negative. This was repeated with double quantities—all negative.

The berries in (5) and (6) were about 50 per cent. black and 50 per. cent. green.

7. Pig fed ¼lb. ripe *Solanum* berries—negative.

8. A 3-months' old Middle Yorkshire pig was fed for eight days as follows:—A.M.: *S. opacum* alone. During the time 5lb. of plant were eaten. P.M.: Mixture five parts swill and one part chopped plant, approximately 10lb. of plant being so consumed. The plants were succulent and fruiting, most of the berries being green and some black. The pig gained 6lb. in weight during the experiment.

Trials with Sheep.

1. An aged ewe was starved for forty-eight hours and drenched with a cold water decoction of 3 ozs. of crushed green berries—negative.

2. Two aged ewes were fed on two succeeding days with the plant. The first day an unknown quantity was eaten, and on the second day 3lb.—result negative.

So far as these experiments go, there is thus no evidence that *S. opacum* has any harmful effects on stock.

In each instance specimens of the plant were submitted to the Government Botanist for identification.

Culture of Berries in the Molong District.

The following reply, sent to a correspondent in the Molong district who asked for certain specific information concerning the culture of gooseberries, raspberries, and red and black currants, should be of interest to others:—

Provided the position is not subject to late frosts, the alluvial soils in your district are suitable. The rainfall is sufficient as far as quantity is concerned, but if they cannot be irrigated during the hot months there would be a considerable risk in growing this class of fruit commercially. Gooseberries should be planted 6 feet by 6 feet apart, which allows about 1,210 plants to the acre, and raspberries and currants 3 feet by 6 feet. Gooseberries should be planted at the end of winter, and currants and raspberries in the middle of autumn. Plough once a year and keep cultivated, and market the crop in 1, 2, or 3 lb. punnets.—S. A. Hogg, Assistant Fruit Expert.

Early Summer Work in the Apiary.

W. A. GOODACRE, Senior Apiary Inspector.

THE early summer (the period between, say, 20th October and 30th November) can be classed as the most progressive period of the season for colonies of bees. The weather conditions are then generally favourable for intense brood-raising, having regard to the prospects of flora in most of the districts that are of interest to bee-farmers. and to other conditions affecting the supply of nectar and pollen.

The population of the colonies is therefore likely to be rapidly increasing, and in order to minimise the desire on the part of the bees to swarm, the bee-farmer will have to pay particular attention to the provision of ample hive accommodation. If it is noticed that a colony anticipates swarming (the preparation of queen cells being evident), it is usually advisable to forestall the issue by artificially swarming the colony. The systematic destruction of queen cells as a method of prevention of swarming cannot be relied upon, for after one or two batches of cells have been destroyed the colony will often swarm without cell-preparation.

The procedure of artificially swarming a colony is as follows: The colony which it is anticipated may swarm is removed and another hive (prepared so as to receive a natural swarm) is placed on the stand: next, place in the new hive a frame of brood and bees and also the queen from the old colony, making sure that there are no queen cells on the brood. Rap on the sides of the hive containing the old colony so that the bees will gorge themselves with honey, and then shake most of the bees from the old hive in front of the new hive and allow them to run in. The supers from the old hive can be put over the new hive, but it is best to put them above an excluder. and it is best, too, to have no brood in the supers so placed.

If increase is desired, the old hive, which now consists of a brood chamber, sufficient bees to care for the brood, and a number of preparation queen cells, can be placed on a new stand. Destroy all queen cells but one, or if the breeding of the bees is not satisfactory, all the cells can be destroyed and a selected cell or queen introduced. If increase is not desired, place the old colony alongside the newly-swarmed colony, with the entrance turned slightly to one side; destroy all queen cells, and in eight days time examine the colony again and destroy any cells, and then place the brood (bees and all) on top of the swarmed colony, the body acting as a super.

As previously mentioned, it is advisable to control swarming. Should increase be desired it is preferrable to depend on artificial methods, such as forming nuclei, for increase of stocks. To take a general outlook for this season, bee-farmers in the next few weeks should be able to build up their stocks considerably. Where the colonies are populous and progressive, and

there are prospects of the flora affording ample provision for young colonies, a reasonable number of nuclei for increase can be formed in the apiary without materially affecting the quantity of surplus honey to be extracted.

The conditions should be favourable during this period, too, for raising good queen cells, and advantage should be taken of favourable conditions to raise cells so that they will be available to place with nuclei for increase, or for the replacing of unsatisfactory queens in the apiary. Some bee-farmers depend on the purchase of queens for their increased stocks, but sometimes queens are not obtainable just at the desired time, and the bee-farmer should on such occasions be able to raise his own queens, so that the best results can be obtained while the good conditions last.

In some apiaries it may be noticed that there are a few colonies that have not made much headway, and that are in a more or less weak condition still. To assist such colonies a frame of emerging brood could be given, but not unsealed brood, for the bees will have as much of that as they can care for. I have had very successful results in giving weaker stocks a good start by giving them a frame of sealed brood which is well covered with bees, the brood and bees being taken from very populous stocks, but in such cases care must be taken that the queen of the populous colony is not removed with the brood and bees. When putting the brood and bees in the weak hive I prefer to remove one of the combs which contains unsealed larvæ, and to put the frame of bees and brood in the place that was occupied by the removed comb.

How Bees Recognise a Master.

When watching the apiarist manipulate his colonies, people not acquainted with the habits of bees almost invariably remark that the bees must know the bee-keeper, their idea being that otherwise the operator would be stung. Such an explanation is inaccurate, however, for the immunity of the bee-keeper is due rather to his understanding of the bees and his accurate anticipation of their behaviour in given circumstances than to the bees' recognition of their individual owner. Bees do, on the other hand, recognise the hand of the master in the manipulations of any bee-keeper whose procedure is competent and assured. They even seem to realise that it is useless, as well as inadvisable, to put up a fight against operations so deliberate and fearless.

In ordinary work the apiarist need use very little smoke, but what is delivered must be given at the right time, for the business of the apiarist is to detect the first signs of excitement and thereby prevent it from becoming general. The amateur bee-keeper has two cares—to preserve the serenity of the bees and to keep cool himself. Bees readily detect nervousness in man or beast; cows can often remain among the bee-hives all day and will not be disturbed, while a horse will usually be cleared out within half an hour. Learn to work calmly and smoothly, carrying out manipulations deliberately and carefully, and using smoke only when actually required, so that the bees are not demoralised by it, and the idea of danger from stings will soon cease to obtrude upon the day's work.—W. A. Goodacre, Senior Apiary Inspector.

Downy Mildew.

H. L. MANUEL, Viticultural Expert.

THIS disease, which was indigenous to North America, was introduced into Europe in 1879, and from there it made its way to Australia, no doubt in some importation of grafted rootlings intended to assist in the reconstitution of Victorian vineyards.

In January and February, 1917, a slight outbreak occurred in the Rutherglen vineyards of Victoria, and during the following season the weather conditions being ideal for its development, it spread with remarkable rapidity early in the season, affecting the bunch as well as the foliage of the vine. Most of the growers up to that time were inclined to treat the disease somewhat lightly, being of the opinion that under our sunny Australian conditions it would not develop to any serious extent; consequently spraying was neglected. The weather conditions that followed, however, were exceedingly favourable to fungus growth, and downy mildew, left unchecked, spread like wild-fire, the prospects of a good vintage dissipating in a couple of days. When vintage time did come round, only a 5 per cent. crop was picked from a district of 6,000 acres of vineyard.

From its centre of first infection Rutherglen its chain-like spread can be traced on all points of the compass, reaching one district after another, until practically every vine area in the State became affected to a greater or less extent. Last season it made its presence felt in Queensland and late in the season made its appearance in South Australia. In New South Wales the Murrumbidgee Irrigation Areas suffered most, the growers there not realising the seriousness of the disease until it had suddenly descended upon them and caught them unprepared. The damage wrought was very extensive, and the losses incurred may take many a year to make good.

It is possible in a dry spring and summer that we may not see a trace of this disease, but to avoid spraying on that off-chance is a very foolhardy proposition. So much is at stake, and the cost of spraying is so comparatively small that every grower should adopt preventive measures early. The disease has come to stay, and though the severity of the attack from year to year depends upon the weather conditions, the fact remains that the man who desires to make grape-growing a success must henceforth be prepared to regard spraying as a regular operation, and to spray efficiently.

All growing portions of the vine are open to attack. On the leaves its first appearance is on the upper surface as a yellowish oil spot. Later, masses of white, thread-bearing spores (whence the term downy mildew) appear on the under surface. The affected portions turn a dead-leaf brown, and when the leaves are badly affected they fall off.

Early in the season the flowers may be attacked, in which case they drop off, but, later, if the berry is attacked, the affected parts assume a livid colour, the berry gradually shrivels, turns brown, and drops off. The fruit is liable to attack right up to the time that the berries begin to turn, and the fungus, given favourable conditions, will reproduce at such an enormous rate that a few days will suffice to destroy the whole crop. Even in cases where the berries are not affected the leaves, being badly affected, will fall off, and in doing so will seriously interfere with the ripening of the fruit.

Grape Leaf with early stage of Downy Mildew. (*After Duggar*.

The mycelium of this fungus is internal and produces summer spores, which issue from the stomata of the leaf on the under surface. These spores fall, and alight on the surface of other leaves, which must have free moisture upon them if the spores are to germinate.

On the approach of autumn, what are known as winter spores are formed in the leaf, which possess a thick coating that protects them during the winter

months. The leaves fall to the ground and decay, leaving the spores in contact with the soil. Under favourable weather conditions in the spring, the sack or coating bursts, liberating the spores, which are washed or carried by the wind on to the leaves of the vine, setting up an infection that reproduces the summer spores.

The treatment must be preventive by the destruction of the very delicate summer spores before they can attack the foliage. This is done by covering the foliage with a very fine film of a corrosive substance that possesses the property of successive solubility, and that will not readily be washed off by the first rain. Such a substance we find in Bordeaux or Burgundy mixture.

From the middle of October onwards can be looked upon as the dangerous period. No hard and fast rule can be laid down, but it is well to make the first spraying when the shoots are about 9 inches long, and to follow with others from time to time as new growth appears.

Grasses and Clovers at Moss Vale.

A report has been received from Mr. R. Waples, Ashmount, Yarrunga, via Moss Vale, on the following grasses and clovers which were planted on 28th February, 1921:—

Elephant grass (*Pennisetum purpureum*) was planted on the high land at Moss Vale and also at Kangaroo Valley. At Moss Vale it attained a height of 6 feet and at Kangaroo Valley 12 feet. Cattle eat it readily and do well on it. If allowed to attain its maximum amount of growth it becomes very coarse, and stock are inclined to leave the stalks, only eating the leaves.* I can highly recommend it to anyone who runs a dairy, as it is a good milk-producer.

Toowoomba canary grass (*Phalaris bulbosa*) attained a height of 2 feet, and at the present time (5th August) is doing excellently. Despite extra heavy frosts, it is still green and very succulent. I can strongly recommend it for a cold climate and to anyone requiring luxuriant winter pasturage.

Kikuyu grass (*Pennisetum clandestinum*) is one of the best grasses I have ever seen. It gives an abundance of luxuriant foliage, although it was slightly affected by the heavy frosts. I planted ten roots in a patch 10 feet square, and in a couple of months the whole bed was covered with succulent forage 6 inches in height. After cutting the plot three times, the grass made about 18 inches of growth just prior to heavy frosts affecting it.

Shearman's clover (*Trifolium fragiferum* var.) is an excellent clover for wet and sour places.

Chilian clover (*Trifolium pratense perenne*) made good growth during the autumn, but was slightly affected by heavy frosts.

* The Department recommends feeding off Elephant grass when it is 2 feet 6 inches or 3 feet high.—J. N. Whittet, Assistant Agrostologist.

Horticulture.

E. N. WARD, Superintendent, Botanic Gardens, Sydney.

Trees to Plant in Warm Coastal Districts.

IT will be convenient first to deal with the warm coastal districts, comprising such places as Gosford, Nowra, Newcastle, and West Maitland, but not the actual coastline, which is somewhat bleaker.

The yellow box (*Eucalyptus melliodora*) is a beautiful, quick-growing shade tree that will grow in almost any soil. It is largely planted in California and several parts of South Africa, in preference to a large number of their own trees, though it is doubtful if there is an avenue of it planted for shade in New South Wales.

The lemon-scented gum (*Eucalyptus citriodora*) makes a fine avenue along a road where there are no overhead wires to interfere with head room, especially if planted running east and west, so that they cast a shadow at midday across the road. For this purpose other countries value this tree highly: its clean straight stem, beautiful foliage, and shapely pyramidal head making it also a very fine specimen tree.

The tallowwood (*Eucalyptus microcorys*) for actual street, avenue, or country road work will probably outdo the above two gums for utility, for it will stand the knife and may be kept within bounds as a shapely tree, while its dark, dense foliage when so treated is more pleasing than even the popular brush box (*Tristania conferta*) of the Sydney suburbs. It should not be thought that because these are native plants that grow wild in the bush they need little or no attention. When they are required to withstand the heavy handicap of street, or hot and dusty road life they want all care for satisfactory results.

The silky oak (*Grevillea robusta*), in poor soil, deeply worked, makes a fine tree unpruned, but if the soil be rich then its beauty is fleeting; and the stone pine (*Pinus pinea*), which is sometimes planted in streets, becomes too gaunt and ugly, for it is a tree that resents pruning into shape.

The camphor laurel (*Cinnamomum camphora*), if the position is sheltered and the buildings not too near the tree-line, makes a very useful and pleasing street tree, amenable to hard pruning, and capable of standing long periods of dry weather.

The palm (*Cocos plumosa*) is most useful for single rows, and so is the lilli-pilli (*Eugenia Smithi*), in districts where scale insects do not overhelm them.

Bleak Situations, and Close to the Sea.

For exposed spots on the coast that have to be planted rather from necessity than choice, the following have proved themselves to be suitable with a little protection during their early stages of growth :—

The Bangalay, or blue gum, of New South Wales (*Eucalyptus botryoides*), can be grown and pruned like the tallowwood. One of the apple-trees

(*Angophora lanceolata*), well planted and cared for, will make good and respond to the pruning knife. The Norfolk Island pine and the hoop pine, of Queensland (*Araucaria excelsa* and *Araucaria Cunninghamii* respectively), are well known at Manly. The Port Jackson fig (*Ficus rubiginosa*), if taken care of until established, will make one of the best trees on our beaches, and in very bleak spots the Moreton Bay fig (for which all gardeners have such a hatred) should be planted.

For sheer hardiness the rata of New Zealand (*Metrosideros tomentosa*), takes some beating. Its fine dark foliage, with brilliant scarlet flowers at Christmas time, have given it the name of New Zealand Christmas tree. Growing right on the beach at Newcastle, this bushy tree lends grateful shade and protection as a break-wind. The funereal and over-planted *Pinus insignis* must be used for this purpose in such places, but inland it should only be planted for box-timber purposes; there are enough planted for ornamental purposes already.

The white oak (*Lagunaria Patersoni*) is often used to advantage. Planted with some kind of shelter, it is surprising how hardy this tree really is.

The coral tree (*Erythrina indica*) may be planted like the white oak, freely, and will stand cutting about in a wonderful way. The only objection to this tree is the litter it makes when it is shedding its leaves. As shelter for pigs and poultry yards it is excellent.

Probably the finest subject for the beach, if proper attention is given it, is the Canary Island palm (*Phœnix canariensis*). If one could only imagine this palmtree (for it really is a tree) in twenty-five years' time with a bold single trunk supporting a head of graceful palm leaves spreading 15 to 18 feet from the stem, high enough to drive under, certainly this palm would be planted more widely. The mistake is often made of not planting them far enough apart—40 feet is quite near enough. Many try to make a stem before the palm is ready for it by cutting away the bottom fronds, but nothing is more injurious to any palm than taking away its foliage before it has decayed naturally; such treatment stunts the plant, and makes only a shrub of it instead of a tree.

The Tablelands.

In this section may be included Bathurst, Moss Vale, Scone, Goulburn, Tamworth, Armidale, Glen Innes, and all similar places.

The ideal street trees for these places are undoubtedly those that are deciduous—trees that give their maximum shade in midsummer, gradually shedding that shade until the direct sun itself becomes a pleasure and the footways get the benefit of its purifying and drying influence. There are, however, exceptions, and the eucalypts are among them. Some of the finest trees are those growing naturally in the district. The apple (*Eucalyptus Stuartiana*), for instance, is growing at most of the places mentioned above as apple chiefly, but in some places as peppermint, woollybutt, sally, and pepperwood. No tree is better suited for ornamental planting than this beautiful white-branched and graceful-leaved gum.

The plane tree (*Platanus orientalis*) is a difficult tree to improve upon, if we except, perhaps, the sweet gum (which is not a gum), of Canada (*Liquidamber styraciflua*). These trees are shapely in habit, hardy and quick growers, and almost free from disease in this State.

Where conditions are very dry the honey locust (*Gleditschia triacanthos* makes a fine upright avenue tree with light ornamental foliage, resembling the robinia without its suckering propensities. This tree also makes fine hedges and groups for sheltering stock. The pin oak (*Quercus palustris*) is one of the best street trees known. Why country municipalities plant suckering elms and robbing pines in preference to this beautiful oak, with its wonderful autumn-coloured foliage, is hard to understand; even the English oak (*Quercus pedunculata*) is far better.

There are several other trees suitable for these places, but the difficulty is they are not easily procurable. There is an excellent ash, for instance, growing in the avenue leading from the entrance gates of Bathurst Experiment farm, called the desert ash, but I doubt whether trees are anywhere procurable. It is a shapely tree, carrying its foliage well into the winter, with a fine habit.

There are also some non-suckering poplars well suited for these places, but nurserymen's stocks appear to be very low.

Extremely Cold Districts.

In places such as the Monaro, where the cold is such that trees (in fact, all plants) enjoy a complete rest, or what the gardener calls a dormant period, one cannot do better than imitate a European style of planting. A visit to such a place as Mount Wilson would serve as a good object lesson. There chestnut, oak, lime, beach, catalpa, elm, ash, poplar, sycamore, zelkova, all revel in the rich soil and congenial climate.

Hot and Arid Districts.

Here is the place for the pepper tree (*Schinus molle*). It is doubtful whether a more graceful or more suitable tree could be found, and though overplanted in places, many way-back towns would look very hot, dry, and dreary were it not for their pepper trees. There are, however, several trees that may be grown with the pepper.

The carob (*Ceratonia siligna*), well suited for a hot, dry climate, is rather slow in growth, but sure. The white cedar (*Melia Azedarach*) is also a good subject, and if the ground is well worked the kurrajong (*Brachychiton populneo*) takes some beating. The tree of heaven (*Ailanthus glandulosa*) is useful; and where there is some water to spare, the oriental plane tree again becomes useful, as does the live or evergreen oak (*Quercus virginiana*). The bunna-bunna (*Araucaria Bidwilli*) makes a change; and if the soil has a retentive wet bottom, the date palm (*Phœnix dactylifera*) and the weeping willow are useful. The sugar gum will grow well for a while, but becomes diseased if it receives a check of any kind. The tallowwood is much more to be recommended.

The Northern Rivers.

In very warm and moist situations, many trees can be recommended for avenues that in other places could only be used as specimen trees. For such places, *Jacaranda ovalifolia* stands out as a charming tree for both foliage and flower. The Illawarra flame tree (*Brachychiton acerifolia*) makes a fine contrast to the blue of the *Jacaranda*.

In wet places *Melaleuca leucadendron* makes an ideal street tree. The native teak (*Flindersia australis*) should be one of the first, and the South African (*Harpephyllum caffrum*) makes one of the most dense and symmetrical trees known. The several figs (*Ficus Bengamini*), weeping fig (*Ficus Hillii*), the white-stemmed fig (*Ficus Henniana*), and *Ficus Cunninghamii* must also be named.

The Queensland bean (*Castanospermum australe*) is equalled only by the pencil cedar or rosewood (*Dysoxylon*). *Eucalyptus citriodora*, the lemon-scented gum, vies with *Eucalyptus diversicolor*, of Western Australia, a gum similar to the blue gum of Tasmania.

The native coogera (*Nephelium divaricatum*), the tulip-wood (*Harpullia pendula*), and *Cupania* of various kinds are trees that are equalled by none when fully grown. Such places as Lismore, Byron Bay, and Grafton could be made the Riviera of Australia, for the range of trees available is legion. The possibilities are such that if the residents only realised them, no place in Australia could catch them up in esthetic tree-planting.

There may be a few trees named among the foregoing that nurserymen do not stock in quantity, but generally no tree has been recommended that cannot be procured.

In many parts of Australia men have ruthlessly destroyed trees to make room for other vegetation, for houses, and highways. There is, however, a growing tendency to preserve and replant; and graziers are beginning to realise that, apart from the beauty of the trees, the grateful shade they afford is economically beneficial to man and animals alike, and the Botanic Gardens authorities are now receiving many inquiries as to the right thing to do.

Unfruitful Figs.

"I have two large fig trees, eight years old; fruit forms, but always falls off."

The reply was to the effect that some varieties of figs are sterile and require other varieties to fertilise them. This might be the reason why the figs did not hold on; to overcome it a branch of the tree should be worked to another variety, so as to provide foreign pollen for cross-fertilisation purposes. Further, root-pruning might be tried. For this purpose, a trench should be dug 4 feet from the butt of the tree and some of the large roots cut. It might be wise to dig down and examine the root system. If the tree had tap-roots they should be cut off.—W. J. Allen.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of wheat, oats, maize, sorghum, Sudan grass, potatoes, and other crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Maize :—	
Golden Glow	J. F. Chick, Hillview, Tenterfield.
Wellingrove (formerly Early Yellow Dent).	Manager, Experiment Farm, Glen Innes.
	J. S. R. Crawford, Emu Swamp, Orange.
Iowa Silvermine (formerly Silvermine).	Manager, Experiment Farm, Yanco.
Golden Beauty	R. Richardson, Mondrook, Tinonee, Manning River.
Manning Pride	S. Smith, Karaak Flat, via Wingham.
Golden Nugget...	J. W. Smith, Wauchope.
Manning White	A. McM. Singleton, Henley, Sydney.
Large Red Hogan (formerly Red Hogan).	Principal, H A. College, Richmond.
Craig Mitchell	W. D. K. Humphries, Muswellbrook.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy (formerly Improved Yellow Dent)	D. J. Dorward, Tayfield, Cundletown.
	J. C. Duff, Mount George.
	P. Mooney, Dumaresq Island, Taree.
	W. Richardson, Dumaresq Island, Taree.
Goldmine	A. Louttit, Moruya.
Yellow Moruya	A. Louttit, Moruya.
Golden King	E. Blackburn, Warkton, Coonabarabran.
Manning Silvermine	R. Dyball, junior, Taree Estate, Taree.
Grain Sorghums :—	
Feterita	W. D. K. Humphries, Muswellbrook.
Manchu Kaoliang	Manager, Experiment Farm, Bathurst.
Millet :—	
Japanese	Manager, Experiment Farm, Coonamble.
****Sudan Grass*** :—	J. Cavanagh, Curlewis.
Clovers :—	
Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
Kikuyu Grass :—	Principal H. A. College, Richmond.
	Manager, Experiment Farm, Lismore.
Elephant Grass :—	Principal, H. A. College, Richmond.
	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Grafton.
Potatoes :—	
Satisfaction	O. E. Silk, Nimmitabel.
	J. D. Morse, Black Mountain.
Surprise	O. E. Silk, Nimmitabel.
Peanuts :—	
White Spanish	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm, Yanco.
	Manager, Experiment Farm, Lismore.

In addition to those tabulated a number of crops were inspected and passed, but as the growers failed to forward samples their seed has not been listed.

* Sudan grass should not be sown until all danger of frost is passed.

Poultry Notes.

OCTOBER.

JAMES HADLINGTON, Poultry Expert.

THE hatching season being practically over, it might be profitable to look back over some of the troubles met with during the past few months. Some of them are more or less chronic, occurring annually, but untoward experiences may be noted with a view to preventing their recurrence in future hatching seasons. It is to be feared that hundreds of poultry-farmers, by continually experimenting on some new theory and following doubtful advice, instead of the beaten track of universal experience and known successful practice, are purchasing their experience so dearly as to jeopardise their chances of success.

Some of the practices one finds going on, in regard to both incubation and rearing, are astounding—almost incredible. Some of them have not even the elements of common sense to recommend them, and colossal losses are the result. This is perhaps a strong indictment, but serious diseases sometimes involve drastic remedies, and often advice that is not altogether palatable.

What should be realised is that, even the most experienced operators will occasionally have indifferent results, the cause of which is perhaps obscure at the time, but it does not follow that because this is so that the farmer should throw overboard methods known to be successful in search of some panacea for the temporary troubles, because in nine cases out of ten a false trail is struck and the difficulties remain unsolved—more often than not are actually accentuated. When difficulties and poor results are being experienced while following known successful methods, it would be much wiser on the part of the farmer if he exhausted all the possible factors that may have accounted for his trouble before taking some freak suggestion that appeals to him as likely to lead to Utopia. More failures occur in this way than in any other.

Some Reasons for Poor Hatchings.

Let us examine some of the factors that make for poor results in hatching, and we shall find them, for the most part, in matters quite within the control of the farmer himself.

(*a*) *Breeding stock.*—Weak or undersized birds may be so from two causes—too-close breeding or bad rearing, or probably both. Successful hatchings are not to be expected in these cases.

(*b*) *Unskilled feeding or feeding upon an unsuitable ration.*—In this connection, as has been already pointed out, a ration that might give good laying results, may yet be fatal to the good hatching of eggs produced by such feeding. This particularly refers to the feeding of a ration with too

high a protein content; in other words, the feeding of too much animal or vegetable proteins in the ration of breeding stock. It has been laid down in these notes that 3 per cent. to 5 per cent. of meat-meal with a protein content of 60 per cent. in the morning mash is ample for breeding stock. Again, such foods as linseed-meal, pea-meal, and all highly concentrated foods should be very sparingly fed to breeding stock. In short, whatever percentages of these foods have been recommended by me for layers might with advantage be reduced for breeding stock to the extent of at last a third, and this *by weight and not measure.* Many farmers have instead largely increased the protein content in the ration, with the idea that they were assisting the birds—a notion that is entirely wrong.

(*c*) *Keeping the male bird well fed is very important.*—This often necessitates a special extra feed for him, say, at mid-day, and preferably a feed of whole maize. Flock matings sometimes fail to give satisfactory results simply because the male birds cannot be given the same attention as in the case of single matings. These, and other incidental happenings which will readily suggest themselves, have a bearing on this part of the problem.

Faulty Incubation.

Given good stock run under good conditions, incubation is the next matter to claim attention. Faulty incubation can spoil all the chances of successful hatching of very good hatchable eggs. Instructions on this operation were published in these notes in June, 1920. These contained, not opinions, but the results of practices universally acknowledged in the main as embodying scientific knowledge and successful practical methods, so much so that any important departure from them must result in poor hatches. Notwithstanding all this, experimentation by the novice goes on merrily, and for it he mostly pays the price.

One of the oft-repeated inquiries is in respect of "dead in the shell," that is, chickens that have been brought practically to the point of hatching but that have failed there. The cause of the failure to hatch after reaching that stage is mostly because the chicken is too weak to come through the crisis consequent upon the passing of the yolk into the abdomen, and the struggle to emerge from the shell. There are other cases in which the embryonic chicken has died before reaching that stage, but the whole of the circumstances can almost be summed up in the one word—weakness. Having gone so far, let us examine the factors that during incubation can be responsible for this weakness. They may be summed up thus:—

(*a*) Failure to maintain approximately correct temperatures, as, for instance, running too low, or too high. (*b*) Failure to turn and cool the eggs in accordance with recognised practice. (*c*) Over-cooling the eggs during incubation, either for too long at a time, or too often, calculated to weaken the embryonic chicken.

The last has apparently been a most prolific cause of trouble this season, and particularly during the latter part of it. Just why an idea of this kind should affect operators with experience seems difficult to understand; nevertheless it has operated. In this connection it should be understood that

opening and leaving open the incubator draw or shutter has the effect of materially lowering the temperatures of the incubator itself, consequently when the eggs are returned to the machine it is some considerable time before the normal warmth is restored, which is equal to so much longer cooling. The result is likely to be late hatchings and weaklings. In machines which necessitate the draw aperture being left open, less time for cooling should be allowed. The idea that eggs require plenty of fresh air is neither according to science nor practice. The facts are that embryonic life is not dependent upon supplies of fresh air as we know it. High temperatures, too, are equally bad, in so much as the embryo chickens can be weakened in this way. Many cripples are likely to result from too much heat.

Retarded Hatchings.

When chickens fail to hatch to time, one or both of two causes may be suspected. (*a*) The temperatures have not been raised sufficiently early (this might happen with either incubator or hen); (*b*) the temperatures have been too low, during part or throughout the hatch, or (*c*) the eggs have been over cooled.

The management of incubators will again be dealt with in time for next season's hatching. In the meantime the close of the season is an opportune time for poultry-raisers to review their last season's methods.

The Fertilising Action of Sulphur.

Mr. Chauzit, Professor of Agriculture at Villeneuve, France, has sent to the *Bulletin de l'Academie d'Agriculture* the following communications:—

"After several years of experiments, it appears possible to draw certain conclusions concerning the use of sulphur as a fertilising agent.

"1st. Sulphur spread over cultivated land has a very distinct action, which is shown by an increase in the crop, varying with the amount of organic matter existing in the soil, the extension of the surface of contact, and the length of time of contact with the soil.

"2nd. This action is in proportion to the quantity of sulphur, a quantity which, it appears, should be, in practice, between 3 and 5 cwt. per acre.

"3rd. The spreading of the sulphur must be done as much as possible in advance of the time in which plants are mostly in need of nutritive elements; in other words, sulphur must be supplied to the soil in the autumn, or at the beginning of winter, ploughed in with stable manure or other organic manure. While 2 cwt. of sulphur spread with stable manure in autumn gives an appreciable result, the quantity must be raised to 3 cwt. when the manuring is done in winter.

"4th. The results ascertained—increase of crop, healthier condition of plants, increased resistance to drought, diminution or disappearance of some diseases—are explained by the fact that sulphur acts by making soluble and easily assimilated the fertilising elements of the organic matter, and of some mineral matters (such as potash) of the soil."

Orchard Notes.

October.

W. J. ALLEN and S. A. HOGG.

On constant and continual cultivation will now depend, to a large extent, the successful production of fruit crops in the coming season. All ploughing should have been finished by this month, and where green crops have been ploughed in or where there are weeds the disc-cultivator will be found very useful in chopping up the vegetation. In many orchards this year weed growth has been very great, owing to the favourable season, and orchardists who have not a disc-cultivator will be at a great disadvantage, as tine-cultivators clog and bring the vegetation to the surface. As the disc-cultivator produces a very fine surface, it will be advisable to recultivate with the tine machine when the weeds or green crop have become thoroughly decomposed, a rough mulch, suitable for absorbing and retaining moisture, being thus produced.

Spraying for Insect Pests.

It is now generally recognised among fruitgrowers that spraying is absolutely essential if the various pests of the orchard are not to take complete possession. From time to time it is said that we have more diseases now than ever existed before. This, of course, is not correct. The true facts are that, a study having been made of insect pests and fungus diseases, they have been classified and are now readily distinguished and may be controlled, whereas in olden days they were not recognised.

In many districts trees will this month receive their first spraying for codlin moth. It is thought by some that it is only necessary to spray the fruit, on the ground that the moth only deposits its eggs on the fruit or specially in the calyx. This is not altogether correct, as many of the eggs are deposited on the leaves and foliage, so that the trees should receive a thorough spraying, and every part be covered with the solution.

Where woolly aphis is present, a dual-purpose spraying may be given by combining arsenate of lead and nicotine washes. A concentrated nicotine extract, such black leaf 40, has proved efficacious.

In some districts green aphis of peaches has been particularly bad, and previous notes have advised early spraying with nicotine washes for the checking of this pest, and also of black aphis. That treatment should now be followed by further applications of nicotine sprays, applied under a pressure of 150 lb. to 200 lb. to the square inch.

In districts where the pear and cherry slug was prevalent last year, and, indeed, in all districts, trees should be carefully examined, and as soon as any sign of it is detected they should be thoroughly sprayed with arsenate of lead at the strength recommended for codlin moth. The slug is rather more serious than growers sometimes think; it has been observed that where it has been very prevalent on cherries in one year it had such an ill effect upon the trees that they bore little or no crop the following year.

The peach tip moth is a very difficult pest to deal with, as the work of the larvæ of this moth is confined in its initial stage to internal attacks on the wood fibre, so that external sprays are not efficacious. The only way to deal with this pest is by individual and united care. Peach trees should be carefully inspected, and if at any time the young growth shows signs of wilting it should be immediately removed and destroyed. By this method (although tedious and costly) much of the young larvæ will be destroyed.

The red spider is readily kept in check where trees have been sprayed with lime-sulphur solution in the early spring, before the buds have burst.

Spraying for Fungus Diseases of Fruit Trees.

The first spraying for black spot of apples and pear should have been completed ere this, and it may now be followed up either by lime-sulphur or Bordeaux mixture, as described in *Farmers' Bulletin* No. 72, entitled "Spraying," of which copies are obtainable at 1s. 1d. post free.

Powdery mildew of apples is getting a strong hold in some districts where the trees have not received proper attention. As previously pointed out, all diseased parts should have been removed at pruning time, but even with extreme care small parts will have been missed, and from now on the trees will require great care and attention, and should be sprayed with atomic sulphur. The Department is carrying out trials with other sprays for the purpose of obtaining a cheaper one if possible, and there is reason to believe that a less expensive spray may be available in the not-distant future.

In most cases where peach leaf-curl is present it may be traced either to neglect to give winter sprayings of lime-sulphur or to faulty application. If the disease appears to be bad, a summer application of lime-sulphur may be made, but, as previously pointed out, this is risky in some cases, as certain varieties of peaches drop a proportion of their leaves if sprayed when in leaf with lime-sulphur.

Shot-hole fungus of apricot and almond should have been checked with the winter application of Bordeaux mixture, but it may appear later in the season, and if so the trees should be sprayed with Bordeaux mixture at summer strength.

Fungus Disease of Vines.

As last season was a wet one, fungus diseases will probably be prevalent in vines this season, and preventive sprays should therefore be used. Winter swabbing of vines for black spot should be followed up by applications of Bordeaux mixture.

Downy mildew, having once made its appearance, may at any time break out, and as an insurance the vines should be sprayed during the growing period with Bordeaux mixture.

It was pointed out last month that as the fumes of sulphur are the destroying agents, winter dusting may have been effective in keeping oidium in check. If not, it should be followed up with a summer application.

D

Dormant Buds and Grafts.

Where young trees containing dormant buds have been planted special attention should be given this month to removing the suckers and tying up the young shoot from the bud as it develops. Where matured trees have been grafted and in cases where the tree has been a very vigorous one it is not always advisable to remove the shoots or suckers from the stock until the grafts have been well established. If the young grafts are too exposed they are apt to blow out, and, further, the rush of sap from a vigorous tree is inclined to make the grafts weak unless the suckers are allowed to remain for a time to partake of the surplus sap.

It is often found advisable to lash to limbs that have been grafted stakes to which the shoots from the grafts can be tied for support to prevent them from blowing out. If the tree is small, stakes may be driven in the ground, fastened to the limb which was grafted, and the young shoots tied later to the stake for support. If this plan be followed very few, if any, of the young grafts should be lost.

NOTES FOR MURRUMBIDGEE IRRIGATION AREA.

Vine-growers will need to have the spray pump and materials in order and at hand this month. For downy mildew, Bordeaux mixture at 6-4-40 strength should have been applied when early buds were bursting, and a second spraying at 6-4-50 should follow in about two weeks, irrespective of weather conditions. Should the conditions favour the disease during the spring, frequent sprayings will be necessary to hold the disease in check. If the prospects are for rain it is well to spray so as to prevent re-infection. As the growth hardens a stronger mixture might be used. Be guided by prevailing weather conditions for late sprayings. The same spray will control black spot

The spraying of pears, apples, and quinces for codlin moth is also necessary and compulsory. If arsenate of lead powder is being used the proportions are 18 oz. of powder to 50 gallons of water. See that powder is thoroughly wet before placing it in the spray tank or cask. If proprietary pastes are being used, follow the directions on the package. Three sprayings at least are necessary.

Peach aphis should be looked for and sprayed with tobacco extracts. In dealing with this pest it is necessary to give a second or third application at close intervals, say three days.

Be sure to use fresh unslaked lime in making Bordeaux. It is well to place the lumps of lime in kerosene tins and solder down airtight. This ensures one of having suitable lime during the spraying season.

Pruning of Citrus.

Citrus pruning should be finished this month. With older trees, inside growth, dead and green, should be removed, and all low-lying wood removed to a height of about 9 inches from ground, to facilitate spraying and ensure better results when fumigating, as low growth is often partly covered with earth and scale and sheltered from the fumes.

The clearing away of this low growth also allows one to detect any exudations of gum on the main stem above and about the union.

Where gum is detected one should examine the tree to see if collar-rot is present. The presence of gum on the stem or trunk is a reliable indication, as a rule, that the tree is affected, and it is wise in such cases to cut away the bark until white, healthy tissue shows, leaving no trace of yellow bark. Apply Bordeaux paste made as follows:—1½ oz. bluestone, 1 oz. fresh lime, 1 pint of water.

Care of Young Trees and Vines.

Those who planted in 1920 will need to watch shoots intended for leaders, and to pinch to outside buds, particularly on the western side. This also applies to young trees planted this season. Where dormant buds are planted the end of the stock should be removed with a slightly sloping cut.

When the bud has grown to about knee-high it should be pinched, taking care to leave the uppermost buds on the western side. Usually the terminal buds produce the more vigorous shoots.

See also that any sucker growth coming away from the stock is rubbed off. It often happens that the stock grows and not the bud. This is the reason why many trees are not true to name. The same applies also where vines have been grafted to other varieties. See that no suckers are allowed to grow below the crown.

Where possible it is well to shelter the main stems of young prunes. Straw or grass serves the purpose.

Where vines were planted in 1920 the bottom wire should be in place to fasten main stem. If this is done and the vines are growing freely, one can often start with the main arms.

Cultivation.

Frequent cultivations are necessary from now on. Hoeing round young trees and vines is essential, care being taken not to disturb roots.

Cleaning of head ditches facilitates watering and reduces the time taken.

The Manifold Virtues of Milk.

If we were to summarize the advantages of milk we would say that it contains food accessories called vitamines, which are necessary to growth and maintenance; it contains proteins of a high quality and that are easily digested by children; it contains mineral matter, especially lime, which is needed for the growth of children; and it contains a fat which, having a low melting point, is easily digested. From the cost standpoint we see that it is cheaper to buy energy for the body in the form of milk than it is to buy it in the form of meat. There is an old saying that "an apple a day will keep the doctor away." I feel that it would be equally true, or more so, to say that an ample supply of milk a day would keep the doctor away. Why not have more milk cows, and, if necessary, fewer beef cattle? The cow gives milk, which is a better food than beef, and she is at least five times more efficient in the conversion of feeds into food than is the beef steer.—C. T. Dowell, in the *Milk Dealer*.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1921.

Society.	Secretary.	Date.
Cudal P. and A. Society	L. R. Barrow	Oct. 5
Narrandera P. and A. Association	W. Canton	,, 18, 19
Hillston P. and A. Society	J. E. Peerers	,, 20
Millthorpe A. and P. Association	C. J. E. Hawken	,, 26
Tweed River A. Society	T. M. Kennedy	Nov. 16, 17
Lismore A. and I. Society	H. Pritchard	,, 23, 24

1922.

St. Ives A. and H. Association	A. K. Bowden	Jan. 13, 14
Albion Park A. and H. Association	H. R. Hobart	,, 20, 21
Kiama A. Society	G. A. Somerville	,, 25, 26
Wollongong A., H., and I. Association	W. J. Cochrane	Feb. 2, 3, 4
Inverell P. and A. Association	A. L. Varley	,, 7, 8, 9
Shoalhaven A. and H. Association	H. Rauch	,, 8, 9
Central Cumberland A. and H. Assoc. (Castle Hill)	H. A. Best	,, 10, 11
Southern New England P. and A. Association (Uralla)	H. W. Vincent	,, 14, 15, 16
Nepean District A., H., and I. Society (Penrith)	C. H. Fulton	,, 16, 17, 18
Dapto A. and H. Society	J. T. Geeson	,, 17, 18
Rydal A., H., and P. Society	S. B. Prior	,, 18
Guyra P., A., and H. Association	P. N. Stevenson	,, 21, 22
Moruya A. and P. Society	H. P. Jeffery	,, 22, 23
Dorrigo and Guy Fawkes A. Association	A. C. Newman	,, 22, 23
Newcastle A., H., and I. Association	E. J. Dann	,, 22 to 25
Robertson A. and H. Society	E. S. Martin	,, 24, 25
Tenterfield A. Society	E. W. Whereat	Feb. 28 Mch. 1, 2
Tumut A. and P. Association	T. E. Wilkinson	March 1, 2
Bega A., P., and H. Society	H. J. B. Grime	,, 1, 2
Oberon A., P., and H. Association	C. S. Chudleigh	,, 2, 3
Berrima District A., H., and I. Society	W. Holt	,, 2, 3, 4
Blacktown and District A. Society	J. M. McMurtrie	,, 3, 4
Yass P. and A. Association	E. A. Hickey	,, 7, 8
Glen Innes P. and A. Society	Geo. A. Priest	,, 7, 8, 9
Kangaroo Valley A. and H. Association	L. W. Vance	,, 8, 9
Campbelltown A. Society	J. T. Deane	,, 10, 11
Gundagai P. and A. Society	A. J. Fuller	,, 14, 15
Mudgee A., P., H., and I. Association	S. H. Somerville	,, 14, 15, 16
Armidale and New England P., A., and H. Assocn.	A. H. McArthur	,, 14 to 17
Cobargo A., P., and H. Society	T. McKennelly	,, 15, 16
Barraba P., A., and H. Association	C. E. Williams	,, 15, 16, 17
Luddenham A. and H. Association	L. W. Eaton	,, 17, 18
Tamworth P. and A. Association	F. G. Callaghan	,, 21, 22, 23
Hunter River A. and H. Association (Maitland)	E. H. Fountain	,, 22 to 25
Camden A., H., and I. Society	C. A. Irving	,, 23, 24, 25
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	April 5, 6
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 10 to 19
Clarence P. and A. Society (Grafton)	L. C. Lawson	May 3, 4, 5, 6
Murrumbidgee P. and A. Association (Wagga)	A. F. D. White	Aug. 22, 23, 24

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Agricultural Gazette of New South Wales.

Improving the Maize Yield.

WHAT THE DEPARTMENT IS DOING FOR THE FARMER.

H. WENHOLZ, B.Sc. (Agr.), Inspector of Agriculture.

WHEN some years ago it was decided by the Department of Agriculture to make a forward move in connection with maize-growing in the State, the position of the industry, especially in relation to varieties, was beset with difficulty and confusion. Many so-called varieties were being grown, but they consisted of so many different types of which there was no preponderance of any, that no idea of the true variety type could be obtained. This position had arisen through many varieties of maize being grown on the one farm or through different varieties being grown on adjacent farms and a large amount of cross-fertilisation consequently taking place. Even on the Government experiment farms many varieties were grown, and it was being found very difficult to keep any of these reasonably pure, even with many precautions to that end.

Initiation of Seed Improvement Work.

It was during the season 1913-14 that it was decided to tackle the question of maize improvement.

In the beginning it was seen that the first step in the production of pure seed must be a rigid practice of having only one variety at each experiment farm, so that its purity could be at least ensured in one way. For this purpose one variety was decided upon which suited the district in which each experiment farm was situated, and only that variety was grown at that farm. On account of the much longer planting season at Grafton, and the need for an earlier as well as a late or main crop variety in the district, two varieties (Leaming and Fitzroy) were continued at this farm, the planting being so arranged that one variety came into flower (tassel) a month or so later than the other, so that no cross-fertilisation could possibly occur between them. At the other experiment farms under the control of the Department where maize could be grown—Hawkesbury Agricultural College, Berry, Glen Innes, Bathurst, and Yanco Experiment farms—other varieties suited to their respective localities were placed, and the initial work of improvement of yield and quality was put under way. After a few years' work in selection and breeding with these varieties, a demand for the improved seed began to spring up, and some of these experiment farms now supply about 500 bushels of seed maize annually to farmers in this and adjoining states, especially in Queensland. The price charged for this seed is fixed each year at a few shillings above the usual market price, in order to cover the cost of the greater handling which is necessary. In preparing this seed for sale, each cob is hand husked, and the irregular and small seed at the butts and tips of the selected cobs is removed, leaving grain of uniform size and shape, which is then shelled and kept carefully free from insect (weevil) attack.

Farmers' Pure Seed Plots.

It soon became evident that the experiment farms thus confined to the production of pure seed of one variety were not representative of all the chief maize-growing centres of the State, some of which have markedly different climatic or soil conditions from those in which any of the experiment farms are situated. From time to time also there came under the observation of the Department in these other districts other varieties of maize of reasonably pure type which had been given careful selection by reliable growers for a number of years, and which had good reputations in their own districts as high yielders or as being well suited to the local conditions.

A careful survey of the maize-growing areas of the State to discover as many of these varieties as possible is proceeding as time permits, and encouragement to keep the varieties true to type is given by advice on selection of seed and their maintenance free from impurity by isolation and other methods.

In addition, the most promising varieties of maize from other countries (chiefly America and Africa) are introduced from time to time, and are placed with reliable farmers in districts considered suitable, being kept under supervision as pure seed.

On all these pure seed plots improvement in yield and quality of the variety is encouraged by advice and assistance on special methods of breeding, such as ear-row testing of ears for performance, or by assistance and demonstration of the value of field selection of seed as the farmer desires.

Further encouragement is given by publishing a list of pure seed maize growers each month in the *Agricultural Gazette*. This enables farmers to get in touch with a direct source of pure seed of a variety suitable for their district, and ensures them obtaining seed that is well acclimatised. Advice as to the best varieties is also given to farmers in any portion of the State who require seed maize suited to their conditions, and, if desired, free samples of a few pounds of several varieties are sent for trial.

Trials of Varieties.

As the Government experiment farms specialise in the growing of pure seed and its distribution, it has been found inadvisable that they should also carry out variety trials of maize in their experiments.

Moreover, the distribution of these experiment farms is not such that the results of experiments testing varieties would be applicable to any but the immediate conditions in the surrounding districts, thus leaving many important maize-growing centres out of the sphere of their usefulness as far as the results of these tests are concerned.

In order that these tests may be thoroughly representative of each of the more important maize-growing districts, the system of conducting variety trials on farmers' experiment plots on farms typical of a large portion of the surrounding district was commenced over ten years ago and is being extended each year. These plots are under the direct supervision of the local

inspector or field officer of the Department, who usually attends personally to the sowing and harvesting and advises as to the selection and preparation of the land and after-cultivation of the crop.

The results of these variety tests, for which the seed is obtained from the Government experiment farms and the farmers' pure seed plots previously referred to, is of great importance in establishing the best variety or varieties of maize in many districts and leads to these varieties being most largely grown. One season's results of these variety trials cannot be taken as any criterion of the best varieties, but after four or five years the best varieties usually show up very consistently. The trials are continued with the best standard varieties and any new varieties which have been imported from other countries or "discovered" from time to time as local varieties of merit in the survey of the State that is proceeding each year.

Maize-growing Contests.

In many districts there are still quite a number of different varieties being grown, and each farmer has a fancy for some particular variety which has apparently done well for him and which he has carefully selected to a certain type.

With a view to testing the producing capacity of these varieties or strains under identical conditions typical of the district, the Department is now conducting contests in co-operation with the agricultural societies in the chief maize-growing centres to discover which are the best yielding kinds. In these competitions, each contestant supplies several pounds of his own seed maize to be sown on the same day on a chosen farm, and all the varieties tried on that farm are given the same cultivation throughout. In these contests, too, the Department makes non-competitive entries of varieties grown on its experiment farms or of the best varieties obtained from reliable farmers in other districts. The great differences in yield between some varieties of maize in these tests have demonstrated that some farmers are unconsciously losing several bushels per acre by not growing the best maize for their districts. The contests naturally result in many farmers in the district obtaining seed of the leading variety from the winners and replacing their old varieties, and they are therefore of great value in increasing the maize production per acre of individual farms as well as being a source of considerable profit to the winner from the large demand for his seed.

By reason of the personal interest and healthy rivalry created in these competitions, they have a wider influence even than the variety trials conducted by the Department on farmers' experiment plots, though these latter are of use in testing new or introduced varieties for their suitability to the district, and comparing them with the standard or best local kinds of maize.

As a result of the variety trials conducted by the Department throughout the State for several years, the different districts have been classified according to similarity of climatic conditions, and recommendations have been made as to the best three or four varieties of maize for each district.

In some districts it is found desirable for a farmer to grow at least two varieties of maize—an early crop and a late or main crop. This distinction

is made in testing varieties, but further work more completely to differentiate betwen these two requirements is necessary. Further investigation is also required to discover the best varieties of maize for the various soil types which occur in any district.

Introduction of New Varieties.

In order to leave no source of possible increase of the maize-yield unexploited, the Department has been active in obtaining from time to time some of the most promising varieties from other parts of the world. These are grown as pure seed plots with reliable farmers in districts to which they are expected to be suited until they become thoroughly acclimatised. They are then tested for yield in comparison with the best standard varieties in the same and many other districts, and are finally rejected or placed amongst the best standard varieties recommended for some particular district.

Most of the introduced varieties come from the United States of America. and some like Funk's Yellow Dent, Iowa Silvermine, and Boone County White have given such good results that they are now confidently recommended as the best varieties for certain climatic or soil conditions in New South Wales.

Among the varieties of maize which have recently been introduced and which are now under trial are Silver King and Golden Glow (two of the leading varieties from Wisconsin), North-western Dent and U.S. No. 133 (two very early drought-escaping or partly drought-resisting varieties from the Great Plains Area in U.S.A.), Minnesota No. 23 and Canada Early Flint (from Minnesota, where maize is grown up to 5,000 feet above sea level), Eureka (a variety from South Africa which has the reputation of standing highest in yield at one of the experiment farms in a six-year average), Chinese Waxy (a variety from America with reputedly drought-resistant pollen), Hopi or Navajo (an Indian variety from the arid districts of America which is claimed to have a drought-resistant adaptation in the seedling stage, and a dwarf drought-resistant habit of later growth), Cocke's Prolific (a "prolific eared" variety from the Southern States of America, which corresponds climatically rather with the far North Coast of our State), and Black Beauty pop corn (from America), for which the manufacturers in Sydney are offering 22s. 6d. per bushel.

A large part of the North Coast of New South Wales, where the bulk of our maize crop is produced, has climatic and soil conditions which seem to be unlike those of any other maize-producing country, and it is not surprising that the best main-crop varieties here should be local productions and not introduced varieties.

On the Northern Tableland and in the Inverell district the climatic and soil conditions seem to approach those of the true "corn belt" of America and the volcanic tablelands of South Africa, and some maize varieties introduced from these older countries have been very successful. Introduced varieties such as Funk's Yellow Dent, Iowa Silvermine, and Early Yellow Dent (from Victoria) more than hold their own with local varieties, and have become largely grown in the districts mentioned.

With some of these introduced varieties there seems a possibility of extending the maize belt into colder and drier districts in the State, where the crop has not yet been successfully grown.

Experiments in Soil Improvement.

While it may not be the same with other crops, it is an axiom in maize-growing that it is impossible to have the land too rich for this crop. No work in maize improvement would therefore be complete without some investigations as to how the soil may be improved by manures and fertilisers, by green manuring, and by systematic rotation of crops.

Experiments have, therefore, been laid down on the experiment farms on which maize is grown, and these will mostly be carried out on permanent sites for many years, or until they have been in progress sufficiently long to draw definite conclusions. In addition, some experiments in soil improvement are made on farmers' experiment plots by the Inspectors of Agriculture in other districts, so that advice can now be given regarding the best treatment for almost every district in the State.

At Grafton Experiment Farm, on the Clarence River, which is one of the largest maize-growing centres in the State, and where alluvial soil is generally so fertile that maize crops can be profitably grown on the same land for many years, experiments are being made to determine whether by green manuring with winter catch crops, such as field peas, vetches, and rape, sown in late maize, the fertility or yielding capacity of the land can be increased or maintained, and incidentally which is the best catch crop for this purpose.

At the River Farm at Hawkesbury Agricultural College, which is typical of a large maize-growing district on the Hawkesbury River, winter legumes (field peas and vetches), sown after the maize crop is harvested, are being tested against summer legumes (cowpeas, soybeans, and Dolichos beans) sown as catch crops in the growing maize crop for the same purpose as above.

On the South Coast, at Berry Experiment Farm, a winter legume crop (field peas) is being tested against red clover in the same way.

At Glen Innes Experiment Farm cover crops, like field peas, rape, and Bokhara or Sweet clover, are included in a test with bare fallow between the hay and maize crops, to discover whether their effect is beneficial or otherwise on the following maize crop, or on the later crops in the rotation.

Rotation Experiments.

As previously mentioned, maize is grown on the rich alluvial flats of the coast for many years continuously without any change of crop. This can certainly be done for a few years without noticeable diminution in yields, more especially on those lands which are periodically enriched by the deposit of silt from overflowing rivers. The only crop which is largely grown on the same kind of soil is lucerne, which is also allowed to occupy the land for several years. As lucerne may be looked upon as a soil-improving rather than a soil-exhausting crop, it would seem that a simple rotation of maize and lucerne would be possible for many years without much reduction in soil fertility.

At Hawkesbury Agricultural College, the effect of a varying number of years of lucerne on soil improvement is being investigated by a study of the yields of the subsequent maize crops, as compared with those in continuous culture without lucerne.

At Glen Innes Experiment Farm, an important series of rotation plots, comprising two, three, four, and five-year rotations with maize, hay crops, and clover, and pasture grasses, has recently been commenced. The results will be of far-reaching value in demonstrating that a more profitable system of farming can be carried on in the New England district by the devotion of a greater area to fodder crops, and the carrying of a larger number of stock than is the case at present.

The Wollongbar Experiment Farm (Lismore) has the typical red volcanic soil of a large portion of the surrounding district, and though maize crops are not largely grown for grain there, some fair yields are obtained. Here an investigation is being carried out as to the value of the summer-growing legumes (velvet beans and cowpeas) for soil improvement as a combination crop with maize for fodder, and also as an alternate crop, or as catch crop with maize, for grain.

At Yanco Experiment Farm, on the Murrumbidgee Irrigation Area, the growth of maize as a summer fodder on dairy farms is as important a farm practice as the provision of winter fodder, and rotation experiments including legumes (summer and winter) as soil-building crops with maize, sorghum, and winter cereal fodder crops have been initiated to determine the most profitable system.

(To be continued.)

Variety in a Ration.

It is sometimes important in feeding animals, and particularly pigs, to remember that a variety of foods in a ration often gives better returns than rations restricted to a single or a few foods. Thus it is seldom possible to get really good results from a mixture of seeds and their products when fed to young growing animals, pregnant animals, or animals in milk. The proteids of the seeds have often a low biological value, their ash constituents are deficient in soda, lime, and chlorine, and they contain too little of those mysterious, hitherto unidentified, growth-producing substances known as vitamins A and C. Dairy by-products and green leaves contain the right things to supplement the grains and make a complete food. For this reason we should always try to include in the diet of young animals and mothers a certain proportion of dairy by-products, grass (good hay), leguminous herbage, or other leafy material. Fish meal, flesh meal, and blood meal are also useful supplements for the seeds.—D. W. Steuart in the *Scottish Journal of Agriculture.*

Pastures in our Wheat-growing Districts.

THE DISPLACEMENT OF NATIVE GRASSES BY INTRODUCED HERBAGE.

[Continued from page 691.]

E. BREAKWELL, B.A., B.Sc., Agrostologist.

Plants Found in Different Wheat-growing Centres.

Orang.—Very little trefoil except in sheltered situations. Barley grass is very common on cultivated lands and flats generally; mallow is abundant in places. The dominant vegetation comprises English and native grasses, the principal being, *Poa bulbosa*, *P. pratensis* (Kentucky Blue grass), Cocksfoot, Rye grass, Danthonia species and Stipa species. In the uncultivated pastures on hillsides, Danthonia and Stipa would easily comprise 80 per cent. of the vegetation. In the summer months *Chloris truncata* and *Andropogon* sp. are very abundant.

Molong.—Principally grass country, but trefoil (in valleys) is more abundant than in Orange. Rat's Tail Fescue is very common. Most of the vegetation is a Danthonia and Stipa association.

Forbes.—Herbage is present in great abundance; on flat country (red soil) it has crowded out the grasses. There may be seen growing in association, in almost equal quantities, Shepherd's Purse, Burr trefoil, Rat's Tail Fescue, Marsh mallow and Musky crowfoot. On the hills the trefoil is less abundant, and the dominant plants are Rat's Tail Fescue, Danthonia and Stipa species. On the river flats *Alopecurus geniculatus* (Foxtail grass). *Bassia diacantha* (Spiny saltbush) and Variegated thistle are common. In old cultivation paddocks Burr trefoil, Cape weed, Marsh mallow, and Shepherd's Purse predominate. Less common are Poppy, Spotted trefoil, Rat's Tail Fescue, and Mustard plant.

Condobolin.—On the light soils, native crowfoot is very abundant, comprising 80 per cent. of the vegetation. The remaining 20 per cent. consists of Danthonia and Stipa species, Burr trefoil and Variegated thistle. On the black soils Barley grass and trefoil grow well, although the latter has not the luxuriant growth it has in the north-west. On the Mallee country the principal vegetation comprises *Atriplex nummularia* (Old Man saltbush), *Atriplex leptocarpa* (Creeping saltbush), Kochias, with small quantities of trefoil, *Zygophyllum* sp. and *Trichinium* species.

Dubbo.—On the slopes Stipa, Danthonia, and Rat's Tail Fescue are very common. On the flats Burr trefoil, Shepherd's Purse, and a small amount of native and introduced crowfoot can be seen. The manner in which the Danthonias may be eaten out by overstocking is well seen on the stock reserves around Dubbo. In an area of 3 square yards it was noticed

that no less than forty clumps of this grass had been eaten down so closely during the drought that 50 per cent. died out completely. Some interesting observations were made between Dubbo and Mendooran, on the new Dubbo-Werris Creek line. Here wheat-farming has just begun, with the result that the native pastures are generally still intact. Trefoil and crowfoot are comparatively rare, and an association of Danthonia and Stipa species predominates.

Wellington.—On the granitic slopes, the association is as follows:—Woolly trefoil, 50 per. cent.; introduced crowfoots, 20 per cent.; *Danthonia* sp., 10 per cent.; other plants (mainly comprising Shepherd's Purse, Pepper weed, native crowfoot, Cape weed, Rat's Tail Fescue, and Cockspur or Saucy Jack), 20 per cent. On an average, about twelve clumps of Danthonia were noticed per square yard, and twenty to twenty-four plants of Woolly trefoil for the same area. On the lower levels Burr trefoil, Barley grass, and Shepherd's Purse predominate. On the river flats stinging nettle and mallow predominate, but in the summer months Couch grass (*Cynodon dactylon*) spreads rapidly and crowds out most of the other vegetation. Very noticeable in this area, and also between here and Dubbo, is the spread of Barley grass in cultivation paddocks and in railway enclosures. In the latter localities native crowfoot is generally associated with it.

Cowra.—On the harder soils of the granitic hills fully 50 per cent. of the vegetation consists of Danthonia and Stipa species. This is particularly noticeable where the rocks outcrop on the surface. The herbage comprises, in order of abundance, introduced crowfoots, Woolly trefoil, Rib grass, Shepherd's Purse, Musky crowfoot, and Rat's Tail Fescue. On the looser soils the following are the most predominant, frequency of occurrence being indicated by the order in which they are mentioned:—Alferilla, native crowfoot, Burr trefoil, Woolly trefoil, Musky crowfoot, Rib grass, Shepherd's Purse, Barley grass, Rat's Tail Fescue, and, later in the season, Bindweed. Nearly all the plants have a rosette habit of growth, giving the appearance of a close, velvety turf. This habit is characteristic of winter herbage in highland districts all over the world; and while producing a large quantity of feed is disadvantageous as it crowds out grasses that, under ordinary conditions, would commence to make good growth in late spring, when the herbage has gone off. The Danthonias and Stipas can compete with the herbage on the harder soils, and some good pastures of these grasses are noticeable throughout the district.

On the flats a very abundant growth of trefoil, mallow, and Variegated thistle is noticeable. The latter grows to a remarkable size in good seasons. In railway enclosures native crowfoot often dominates the situation. Barley grass is very abundant in old cultivation paddocks.

Young.—A greater abundance of Danthonia and Stipa than exists at Cowra is noticeable. With these two grasses are associated Woolly trefoil and Hare's Foot trefoil. Burr trefoil is not very common on the flats, but Variegated thistle, mallow and Barley grass grow in abundance.

Gilgandra.—On the light soils at Gilgandra. Rat's Tail Fescue has a strong hold, comprising fully half of the vegetation. Associated with it are Woolly trefoil, Alferilla, Musky crowfoot, native crowfoot, Rib grass, mustard plants, and Shepherd's Purse. Growing among these plants are occasional clumps of Danthonia and Stipa species. On the black soils Burr trefoil, Cockspur or Saucy Jack, Variegated thistle, Barley grass, and *Ajuga australis* (a native herb) are common.

Between Kamber and Curwan the Danthonia and the Stipa grasses are abundant on the light soils, but on the heavy soils Barley grass, trefoil, and crowfoot are most common. Large areas of an association of *Helipterum floribundum* (Wild daisy) and Rat's Tail Fescue can be seen.

In the summer months a fair amount of Panic grasses is found on the heavy soils.

Fig. 8.—A dense sole of Danthonia grasses in the Riverina.

Harden.—The vegetation in this district closely resembles that of Young but more Barley grass is noticeable.

Gulgong and Yass.—These districts have very similar temperatures, and the introduced herbage is similar. Here the shallow soils of the granitic hills carry very little herbage, and very fine grass associations, comprising Danthonia species, Rat's Tail Fescue, *Pappophorum nigricans* (Black Heads) and *Chloris truncata* (Star or Windmill grass) are noticeable. At Gulgong, Kangaroo grass still persists in protected areas. The comparatively small amount of herbage that exists is generally confined to the flat country, and consists mostly of Musky crowfoot, Burr trefoil, and Variegated thistle. Introduced Brome grasses are common in the late spring, particularly *Bromus mollis* (Soft Brome grass).

Wagga Wagga.—On hills with shallow, rocky soils the following association appears to be the most common :—Ball clover, Barley grass, Cape weed, Rat's Tail Fescue, Slender thistle, Cockspur or Saucy Jack, and, in a lesser

degree, *Silene gallica* (Catch Fly), Stipa, and Danthonia grasses. On the flat country very large areas of Cape weed can be seen, with the plant taking possession, and sometimes native crowfoot crowds out all other plants. In well-managed pastures Danthonia and Stipa grasses can easily hold their own against other herbage. On old cultivated lands, and also on the lower parts of the hills, the introduced Brome grasses, Great Brome grass, and *B. tectorum* var. *longipilus*, are common.

Urana.—A large amount of Danthonia and Stipa species is seen on the light soils of the flat country. In judiciously stocked paddocks they predominate over Musky crowfoot and Burr trefoil. In heavily-stocked paddocks, however, Cape weed, with leaves 6 to 8 inches long, and also Musky crowfoot have completely choked them out. In some paddocks about fifteen Danthonias and six Stipas per square foot were noticed. Woolly trefoil is absent in this country. In old cultivated lands Cape weed and Barley grass are very common.

Milbrulong.—Danthonias and Stipas are very common on the hill-sides, with an average of twelve plants per square foot. Herbage associated with these grasses comprise Burr trefoil, Alferilla, Ball clover, and a fair amount of ranunculus in low situations.

Narrandera.—On the light soils an abundance of Ball clover can be seen, comprising 80 per cent. of the total vegetation. The remaining 20 per cent. consists of Barley grass, Danthonia and Stipa species, Woolly trefoil, Burr trefoil, and the introduced crowfoots. Around the sheep camps are thistles (particularly Slender thistle) and nettles. On the heavy soils (river flats) Burr trefoil and Barley grass is the principal association.

Bathurst.—The shallow soils have mostly Danthonias, Stipas, and *Pappophorum*, with occasional *Phalaris minor* (Wild Canary grass). Wild sage is very abundant in old cultivated lands, often crowding out other vegetation. On the flats Barley grass is very thick. The principal trefoil is the Spotted trefoil, although the Burr trefoil grows well in sheltered situations.

Carcoar.—Danthonia and Rat's Tail Fescue predominate on the hills. Musky crowfoot and Barley grass are common on the flats.

Canberra.—On the Federal Territory at Canberra an analysis of the herbage on alluvial soils was made, and the following numbers of plants per square yard were noticed :—Shepherd's Purse, 75; Rat's Tail Fescue, 125; introduced crowfoot, 35; Burr trefoil, 85; *Danthonia* sp., 20. On the lighter sandy soils, however, crowfoot comprised 70 per cent. of the vegetation Most of the herbage is of a rosette character. On the river banks Variegated thistle, Barley grass, and Burr trefoil predominate, with practically no grasses.

Crookwell.—There is very little herbage here. Most of the vegetation consists of grass associations of Poa, Danthonia, Eragrostis, and Rye grass. *Hypochœris radicata* (Cat's Ear) and *Helipterum* sp. are fairly common in late spring.

Glen Innes.—Most of the vegetation on the cleared hilly land consists of English grasses (naturalised), *Danthonia* sp., and (very little) *Stipa* sp. In partly cleared land, Kangaroo grass, *Poa caespitosa* (Tussock Poa), and *Sorghum plumosum* (Wild sorghum) are common. In old cultivated lands, Barley grass and English trefoil grow well. Black thistles are common on the flats.

Inverell.—Here much more trefoil and crowfoot exist.

Narrabri.—A common association on the lighter soils is Burr trefoil, *Medicago laciniata* (a Burr trefoil), native crowfoot, Wild Geranium, Chloris, and Eragrostis. The black soils have a prolific growth of Barley grass, Marsh mallow, and Burr trefoil.

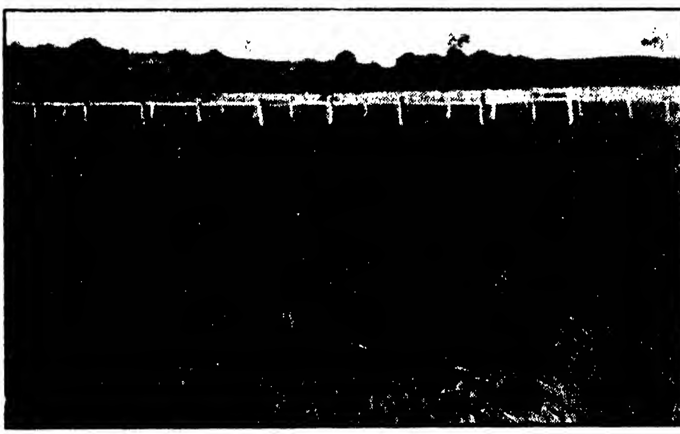


Fig. 4.—Toowoomba Canary Grass (*Phalaris bulbosa*) at Orange

Liverpool Plains.—On the heavy black soils of the Liverpool Plains, Variegated thistle, Wild Geranium, Wild Carrot, and Panic grasses are fairly common. Danthonia grasses are practically absent on the black soils. On the lighter soils of the hills Woolly trefoil and *Danthonia* sp. are common.

Habitats of the Herbage Analysed.

An analysis of the habitat of the introduced herbage clearly shows that it is dependent on (*a*) soil conditions, and (*b*) climatic conditions.

As regards (*a*), two broad divisions are generally made by pastoralists with regard to the herbage growing; that is, it is either "trefoil country," or it is "crowfoot country."

Trefoil country usually refers to river flats such as are found on the Murray, Murrumbidgee, Lachlan, Macquarie, Castlereagh, Bogan, and Namoi rivers, or on the black-soil plains of the North-west, and the Central-west; crowfoot country generally refers to the light granitic soils so common in the Riverina and the South-western, Central-western, and North-western Slopes.

The impression intended to be conveyed by using such terms is that either trefoil or crowfoot predominates, but a close examination shows that, although one of these two plants may comprise over 50 per cent. of the vegetation, an association with many other plants generally occurs.

If the associations in the different districts be closely examined, it will be seen that:

1. Burr trefoil is dependent on temperature as well as on soil conditions It will not grow well where the winters are too long, that is, where the mean temperatures of September and October are below 52 degrees and 60 degrees respectively. Neither does it thrive on the shallow soils of rocky hills. Its best growth is on the stiff or alluvial soils of the flats.

2. Woolly trefoil replaces ordinary Burr trefoil on rocky hills, provided the temperatures are suitable for both.

3. Barley grass is not dependent on temperatures, being found during the spring in the coldest as well as the warmest localities right throughout the State. It occurs most frequently on old cultivated lands.

4. Native crowfoot is adapted more to the short warm spring climates than to the long winter climates. In such situations it often dominates all other herbage on light soils, but is subordinate to other herbage on stiff black soils.

5. The introduced crowfoots are found under all temperatures. Where the mean temperatures of September and October are below 55 degrees and 62 degrees respectively, they generally partake of a rosette character, and constitute the greater proportion of the herbage.

6. Variegated thistles must have alluvial or basaltic soils for their best development. The Black thistle also grows well on such soils.

7. Cockspur, Star thistle, and Slender thistle grow well on light soils, often being abundant in such situations.

8. Cape weed grows well on old cultivated lands, or in paddocks adjoining cultivated lands.

9. Ball clover grows extremely well, often dominating the situation, in the Riverina, and appears to depend mostly on a good winter and spring rainfall.

10. Rat's Tail Fescue grass is just as abundant under cold as under warm conditions, but it is more partial to the light than to the heavy soils

11. The introduced Brome grasses are now rampant on the Southern Tableland and South-western Slopes, and appear to depend on a moderate temperature during the spring, and on a good rainfall.

12. The Danthonia and Stipa grasses, in the hilly country right throughout the State, are the most persistent of all our native grasses. In such situations they do not appear, under judicious management, to become crowded out by the herbage. On flat country, such as river flats and basaltic soils, practically all the native grasses, with the exception of *Chloris truncata* (Star

or Windmill grass), have been choked out by the herbage, and what were once plains of good native Panic, Andropogon, and Anthistiria grasses during the summer months, are now singularly bare during that period.

13. The less abundant the herbage, the greater the variety of grasses. This is well seen in New England, Bathurst, and Orange.

Practically all the summer herbage is found on old cultivated or fallowed lands right throughout the State, with the exception, perhaps, of Wire Weed, which is encroaching on pastures. Such summer herbage mainly comprises Wire Weed, Prickly Lettuce (*Lactuca scariola*), Wild melon (*Cucumis myriocarpus*), Stink grass (*Eragrostis major*), introduced Eragrostis grasses, Barnyard grass (*Panicum crusgalli*), and Summer grass (*Panicum sanguinale*). Stink grass often grows so thickly as to crowd out all other summer vegetation. Barnyard grass and Summer grass grow best in the moist situations.

Speaking generally, native grasses have nothing to fear from summer herbage.

(*To be continued.*)

Jerusalem Artichokes as Feed for Pigs.

Mr. H. N. Pile, St. John's Park, forwards the following account of experiments conducted by him in relation to the qualities of Jerusalem artichokes as feed for pigs:—

"Five pigs were hurdled on about a quarter of an acre of maize and cowpeas. When this crop was eaten out the animals were removed to a similar area of maize, artichokes, and sweet potatoes. The maize (with cobs in the milk stage) was eaten first: then the artichokes and sweet potatoes with equal readiness.

"The pigs were then moved to a patch of cowpeas, sweet potatoes, and artichokes. A frost caught the sweet potatoes but did not affect the artichokes, and, as a consequence, the pigs did very little rooting for the potatoes, and ate the artichokes in preference. The sweet potatoes rotted, but the artichokes (planted at the same time) were perfectly good and ready to grow the following September. They had no chance, however, as two of the sows had litters early in August, and in late September these young pigs found their way through the hurdles and amused themselves by eating the maize I was planting and varying their diet with the artichokes.

"I have a few pigs here at present grazing on wheat, oats, and barley, but although I intend planting some sweet potatoes, I have already planted some artichokes, and some more are in the shed ready to plant next week, as I intend getting in as many as I have room for."

The foregoing is an interesting and useful note, but it may be remarked that the keeping qualities of Jerusalem artichokes depend to a large degree upon the local conditions, and it is, therefore, impossible to make definite statements as to their comparative qualities in this respect. In a review of certain experiments in this *Gazette* in August last, this qualification was emphasised. Frequently the practical value of artichokes for the purpose in question will be best determined by the pig-farmer as Mr. Pile has determined it—that is, by trials carried out on the farmer's own property.—A. H. E. McDonald, Chief Inspector of Agriculture.

A Farmer's Experience with a Pit Silo.

"Last November I put down an ensilage pit and filled it with lucerne, but since then the surface has sunk until now it is about a foot below ground level, and the late rains have filled the hole with water. It had originally been covered with about a foot of clay taken out of the bottom of the pit, and as a mob of cattle running in the paddock seemed to make a camping ground of it, it has been trampled and is, I think, practically waterproof and seems to be holding the water. The pit is about 8 feet deep. Would enough water leak through to damage the ensilage? Could I find out whether it is good or not? The pit is on a rise and there is not likely to be any soakage anywhere else. If the ensilage should still be good, would it be advisable to remove the top earth, and to fill with more lucerne this year on top of the old ensilage, making it well up above the level of the ground?"

"It is probable (was the Department's reply) that no harm has been done to the silage, which might be inspected by removing a portion of the soil about 3 feet square near the centre of the pit. Even if the silage is decayed on the surface it may be all right a little way down. If there is any rotten stuff it could be removed about the time the lucerne is fit to put in and the pit refilled, or, the earth could all be removed and the pit refilled. If this is not done, more earth should be heaped over it to make it a little higher than the surrounding country. No harm will be done by opening the pit for inspection if the hole is refilled."—A. H. E. McDonald, Chief Inspector of Agriculture.

The Larkspurs as Poisonous Plants.

In this *Gazette*, May, 1921, p. 326, I stated, on the authority of a Bulletin by Mr. A. C. Crawford of the United States Department of Agriculture, that some larkspurs have been accused of sheep poisoning. My attention has now been invited by Dr. W. W. Stockberger, Physiologist in Charge of Poison Plant Investigations in the United States Department of Agriculture, to the fact that larkspur is not a source of danger to sheep. I take the following passage from his letter:—

> If you have not seen an account of some of our work on poisonous plants more recent than the bulletins by A. C. Crawford, I feel sure you will be interested in a more recent publication entitled "Larkspur Poisoning of Live Stock," which I am sending you. It has been definitely established that certain of our American species of larkspur are very poisonous to cattle, but careful and extended experiments made with sheep give us every reason to believe that sheep are never injured by feeding upon larkspur.

The following Bulletins by the United States Department of Agriculture bear out Dr. Stockberger's statement, viz., Bulletin No. 365, "Larkspur Poisoning of Live Stock"; Farmers' Bulletin No. 988, "Larkspur or Poison Weed."

I may state that I have no further local information on the subject.—J. H. Maiden.

Sprouted potato seed which is infested with aphis may be rid of it by dipping in a solution of soapy water. Such a solution is cheap and effective and will not damage the shoot in any way.—A. J. Pinn, Inspector of Agriculture.

A Rotation for Wheat Farmers.

H. BARTLETT, Inspector of Agriculture.

It is pleasing to note that the system of farming practised in the western district is indicative of an increasing appreciation by farmers of the principles underlying scientific agriculture. In this district, satisfactory and consistent yields of wheat can hardly be expected when the crop is grown continuously on the same land, the soil being merely ploughed and cultivated, or perhaps only disced just prior to sowing. Up to a certain point, yields will be governed by the amount of working the soil has received. It has become recognised that the policy of a minimum amount of work and a maximum of luck, is not conducive to a prosperous and happy life on the land. Such a policy appeals only to the instincts of a gambler, who may be prosperous one year, but almost "broke" a few years later.

With large areas and favourable seasons, a few have made fortunes by continuously sowing wheat on stubble land, but a greater number have experienced great hardships with the advent of drought, and the money saved during the years of plenty has disappeared in providing for the necessities of life and in feeding working horses during the lean years. Such is the case when the areas are large. Then how much greater is the chance of failure as the areas become smaller, if such a policy is persistently followed? The aim of the farmer should be, not to chance making a fortune during a few years, but rather to follow a system which will ensure a comfortable yearly income during his life on the farm. To this end, it is well to consider the advisability of following a system of mixed farming—sheep and wheat, in conjunction with a suitable rotation. Results have shown that the Department of Agriculture has been fully justified in stressing the absolute necessity of fallowing for the successful growing of wheat, and this system is becoming largely adopted. For the successful working of the fallows, stock are necessary, preferably sheep, and so the system immediately becomes a mixed farming proposition.

Unless fallows are kept clean during the summer months the weeds deplete the soil moisture to such an extent that the object of the fallow is largely defeated. One of the main constituents of fertile soil is humus, or decayed vegetable matter, and depletion of this humus takes place by a process of slow decomposition. This action occurs most rapidly in the hot, dry districts, especially so when the land is under fallow. If an attempt is not made to maintain the humus content of soils, the land will lose the desired physical condition, become difficult to work, easily caked, and will lose its water-holding capacity. As satisfactory and consistent yields cannot be produced without fallowing, and as this system depletes the soil of vegetable matter, the question arises how best to maintain the humus content. The Department has been alive to this question and experiments have been established to demonstrate a system that is commercially sound, and

applicable to extensive areas. It is rightly assumed that every present wheat farm will, within the next few years, become a mixed farm—sheep and wheat, and instead of sheep being considered somewhat of a side-line, they will become a definite and fixed source of income.

The system recommended is a rotation of wheat, winter fodder crop, and fallow. The winter fodder crop will consist of barley or oats, mixed with field peas, tares, or rape (preferably a legume). The working of the rotation will be somewhat as follows:—

As soon as possible after the wheat is harvested in December, the land is prepared for the winter fodder crop, which is to be sown in March. The winter fodders are grazed until August-September, and the crop ploughed under during early spring, the paddock being allowed to remain under bare fallow until the sowing of the wheat crop in the following May. The winter fodders will thus occupy the land for six months, and will be suitable for grazing for a period of three and a half to four months. Such a crop makes much better growth than the natural herbage, owing to the better conditions of ground secured by the working, and in many years when no natural herbage is available a splendid growth is obtained which is invaluable for lambing or for fattening sheep for the market. Except in the drier parts of the western district, perhaps the most profitable and economical method to fallow would be to grow two successive wheat crops upon the one fallow, having portion of the farm each year under winter fodders.

As an illustration, let it be assumed that an area of 600 acres is fit for cultivation. During June the area would be cropped as follows:—200 acres wheat sown on fallow (of which 100 acres is on fallow after winter fodder crop); 200 acres wheat sown on stubble; 100 acres under winter fodder crop: 100 acres stubble waiting to be fallowed during August. During October there would be 400 acres of wheat and 200 acres bare fallow.

Under this system the whole of the area would have grown a winter fodder after a period of six years, and by grazing, and ploughing the last growth under, a green manure crop would have really been returned to the soil. Special advantages of this system are that wheat is sown on 200 acres of fallowed land, and experience has shown that even in exceptionally dry years a fair yield is obtained owing to the moisture which is conserved in the fallow, while in fair or good years a heavy yield is obtained. This fallowed land does not require much working to prepare it for sowing, and the 200 acres of stubble land can be broken up early, and in consequence the total 400 acres can be sown early.

All farmers are agreed that early-sown crops give the best yield. Further, the fallowing helps to destroy weeds, such as cape-weed and wild oats, which so seriously reduce the yield, and the above system will, within a short time, completely free the land from these weeds. The advantages of including a winter fodder crop in the system of farming are:—The humus content, the water-holding capacity and the physical condition of the soil, as well as the supply of plant-food are all maintained, and in some cases increased. Green feed is supplied when most needed, and the stock carrying capacity of the farm correspondingly increased.

Farmers' Experiment Plots.

Maize Experiments, 1920–21.

Murrumbidgee Irrigation Area.

A. N. SHEPHERD, Assistant Inspector of Agriculture.

Experiments with maize for grain were conducted during the past season in co-operation with the following farmers:—

W. Evans, Farm 139, Leeton.
H. Booth, Farm 854, Whitton.
M. Broughton, Farm 597, Griffith.
R. Tiffen, Farm 319, Leeton.
E. J. Polkinghorne, Farm 728, Leeton.

The season was ideal from the maize grower's point of view, both for the spring and the autumn sowing; splendid rainfalls were recorded throughout, and the absence of excessive hot winds was also very pronounced. Rainfall registrations were as follows:—October, 166 points; November, 153; December, 386; January, 169; February, 103; March, 252; April, 122.

The yields were very satisfactory, and it was also noticeable throughout the area that the returns this season were well above the average of a number of years. The value of lucerne in relation to the fertility of the land was clearly demonstrated on Mr. Evans' farm, for although the previous crop had been Sudan grass, lucerne had been grown on the land previously for a number of years. It is usual with most farmers to sow maize for grain as an autumn crop, this practice being considered advisable for the reason that the maize is not so liable to injury by hot winds at the tasselling period, but in this particular season the yields obtained from spring sowing were as heavy as those from the autumn crops. The season was exceptional, however, and the results cannot be taken as justifying spring sowings. In most instances the land received a short fallow—not so much to conserve moisture as to sweeten the soil and ensure a good seed-bed. In dry seasons it is customary to irrigate previous to sowing, but this was not necessary—except in one case in plots under review.

The varieties recommended for the area are the quicker maturing ones, although in this season the later ones gave heavier yields. Fitzroy (late Imperial Yellow Dent) returned 77½ bushels per acre, and Yellow Moruya 70 bushels with a spring sowing, while in the autumn Fitzroy gave 75 bushels and Ulmarra White-cap 64 bushels.

Details of the Plots.

Farm 139.—Red clay loam; ploughed August; cultivated August, September, and October; harrowed October; sown by hand 15th October in furrows 3 feet apart; two grains every 2 feet, with 140 lb. superphosphate per acre.

It was intended that this plot should be harvested for green fodder, but owing to the abundance of other fodders and the promise of a good yield it was allowed to mature grain, with very satisfactory results. The crop received only one watering in February.

Farm 854.—This land (a red clay), although irrigable, had not previously been watered. Ploughed June and again in November; cultivated and harrowed in November; sown 17th December; seed, 16 lb.; superphosphate, 70 lb. per acre. The yields are attributed to the good tilth of the land, and to the fact that the land had not received any previous irrigation This class of land appears to give better results with the first crop than after it has received a number of waterings.

Farm 597.—Red loam; previous crop pumpkins; ploughed October· cultivated November; irrigated 3rd December, cultivated and harrowed 10th December; sown 17th December with maize-dropper in drills 3 feet apart; seed, 10 lb.; superphosphate, 70 lb. per acre. Rather a patchy germination, but a fair crop resulted. This crop received two waterings, one in February and one in March.

Farm 319.—On this farm a manurial test was carried out with Funk's Yellow Dent. The soil consists of a red sandy loam; the previous crop was sorghum, 1919. Ploughed July; harrowed August; disced October; cultivated November, and cultivated and disced December; seed dropped by hand 10th December in rows 3 feet apart at the rate of 10 lb. per acre. A fair germination was obtained, and the crop made satisfactory growth, the grain being picked in May.

Farm 728.—A manurial test with Wellingrove (late Early Yellow Dent) was conducted on this plot, which is of grey soil. The land had been fallowed for some considerable time. Ploughed November; cultivated springtine; disced and harrowed December; seed dropped by hand in furrows 3 feet apart at the rate of 10 lb. per acre. Although the land was in splendid tilth, with ample moisture, a very poor germination resulted, making yields not comparable. The actual returns are given on page 779.

The best sample of grain was obtained from the spring sowing; it was well-filled, plump, and produced a nice dry grain, whereas the grain of the autumn sowing, and especially the later-maturing varieties, although well-filled, was also very moist, and owing to the wet season trouble was experienced in drying. It is very doubtful if such a class of grain would be profitable to grow to put on the open market; its chief value would be as a pig fodder on the home farm. It is for this reason that the quicker-maturing varieties are recommended. U.S. 133 has been picked in eighty-seven days from sowing, though this variety has the drawback that it is not a prolific cropper. It is very suitable for the short season, however, and ripens before the wet and cold weather sets in. Brewer's Yellow Dent gave promise of being a suitable variety for the district and is worthy of further trial.

It is usual in growing maize under irrigation to furrow, water, cultivate, and hill in the early stages, and when once the maize has attained sufficient height to shelter the land to dispense with cultivation.

RESULTS of Variety Trials.

Variety.	Farm 139.		Farm 854.		Farm 597.	
	bus.	lb.	bus.	lb.	bus.	lb.
Fitzroy	77	28	75	0	....	
Yellow Moruya	70	0	....		....	
Cocke's Prolific	64	35	45	10	....	
Ulmarra White-cap ...	54	14	64	0	....	
Red Hogan...	....		62	7	......	
Brewer's Yellow Dent ...	....		....		44	7
Early Yellow Dent ...	....		....		40	5
Funk's Yellow Dent ..	....		....		40	5
Silvermine	....		....		36	4
Silver King	....		......		32	3
U.S. 133	....		....		24	2

RESULTS of Manurial Trials.

Farm 319 (Variety, Funk's Yellow Dent). Fertiliser per acre.	Yield.		Farm 728 (Variety, Wellingrove). Fertiliser per acre.	Yield	
	bus.	lb.		bus.	lb.
* 91 lb. M7	43	22	280 lb. superphosphate ...	22	25
* 1 cwt. M6	38	32	1½ cwt. M7	21	3
140 lb. superphosphate ...	30	14	140 lb. superphosphate ...	20	9
70 lb. superphosphate .	28	10	2 cwt. M6	19	36
			No manure . .	14	41

* The mixture M7 consists of superphosphate, 10 parts and chloride of potash, 3 parts; M6, of superphosphate, 5 parts and chloride of potash, 3 parts.

Western District.

H. BARTLETT, Inspector of Agriculture.

THE following farmers co-operated with the Department in conducting maize experiments last season:—

F. Bennett, Corryburl, Narromine.
J. Parslow, Collie-road, Gilgandra.
E. J. Allen, Gregra.

The only satisfactorily comparable results were obtained at Gregra.

The area cropped with maize in the western district is very limited, though most farmers in the more favoured centres make a practice of annually cropping a few acres, which, if not very payable, at least provide very useful feed for home consumption. Satisfactory crops for commercial purposes can usually be obtained in such centres as Orange, Molong, and Wellington, especially if river flats are available. Further west, however, river flats are almost essential, and in most seasons irrigation is necessary.

Yields of from 50 to 60 bushels per acre may be expected from irrigated river flats in such centres as Forbes, Wellington, and Dubbo, but without irrigation the crop is more or less risky; some high yields were obtained

during the past season on "dry" areas, owing to the favourable conditions, but it would be unwise always to expect such high returns.

Although a crop of maize may not be a marketable asset in this district, a small yield will nevertheless often handsomely repay the grower, inasmuch as he has maize available for feeding to horses during the time when work is most severe on the team. Whether sites suitable for maize production (such as river flats or rich upland soils) are available, and whether the cost of production will be less than the cost of purchasing the feed maize required for home use, are considerations for the individual farmer. By the introduction of new sorts and a system of selection, the Department of Agriculture is bringing forward varieties that are more suited for the drier and warmer portions of the State, and it is quite possible that ultimately small areas of maize will become a familiar sight in the wheat districts.

The varieties recommended by the Department appeared in this *Gazette* last August, pp. 534-535. The time of sowing in the drier districts is of great importance, though the most suitable month cannot positively be stated, as so much depends upon the prevailing conditions. Crops sown in September or early October may make excellent growth, and show indications of cobbing well, but dry, hot winds occurring during late December or early January may have the effect of drying the pollen, thus preventing fertilisation of the cobs. This is what happened with the plots at Narromine, where, instead of the 50-bushel yield promised, only small moist patches successfully produced grain. Under irrigation, the plants would have an unlimited supply of moisture to draw upon, and failure to pollinate properly would probably be obviated.

Provided the moisture content of the soil is suitable, December sowing would probably give best results from maize in this district, as the fertilisation of the cobs would take place during the cooler month of March. A wise plan would be to make two sowings—late September and December.

On the western slopes, the September-sown crops will probably have to contend with the weed commonly known as "stink grass," which appears most abundantly during November. The matter of cultivating between the drills is a difficult one in the case of wheat-growers, as the work requires to be done during harvest operations, and if it is neglected small crops must result.

RESULTS of Trials at Gregra.

Variety.	Fertiliser per acre.	Yield per acre. bus.	lb.
Iowa Silvermine	70 lb. superphosphate	38	28
Iowa Silvermine	35 lb. ,,	30	19½
Iowa Silvermine	No manure	33	44
American Golden Superb	35 lb. superphosphate	18	8
Silver King	35 lb. ,,	19	36
U.S. 133	35 lb. ,,	28	5
Brewer's Yellow Dent	35 lb. ,,	31	2
Golden Superb	35 lb. ,,	30	36
Golden Glow	35 lb. ,,	25	30
Early Canada Flint	35 lb. ,,	23	21
Wellingrove	35 lb. ,,	27	17

Upper North Coast District.

W. D. KERLE, Inspector of Agriculture.

EXPERIMENTS with maize were sown at fifteen centres representative of the Upper North Coast district in the season 1920-21. Owing to the vagaries of a season peculiar in many respects, results are not available from seven of these localities. Although these crops were not absolute failures (except at Eastern Dorrigo, where the trial was completely ruined by flood waters) it was impossible to obtain comparative results.

A manurial experiment sown with Leaming on 26th October on the site of an old lucerne paddock on the farm of Mr. A. Eggins, Grafton, made remarkable growth in the first four weeks, but after a spring which was abnormally wet for the district, December was rainless with hot winds, with the result that the crop tasselled and ripened prematurely and became useless for experimental data. At Lawrence a similar experiment sown early in January germinated very badly owing to weevily seed, and was fed off.

On the Nambucca a variety and manurial trial, sown on 1st December on the property of Mr. M. J. Reedy, Warrell Creek, failed through leaf blight in the early varieties and a particularly severe invasion in the late varieties by the maize ear worm. Leaf blight, abnormally wet weather in January and February, resulting in mouldy ears through lodging, and severe weevil attack in the field, were responsible for results not being recorded in the experiments carried out on the properties of Messrs. H. Short (Dorrigo), Chas. Oliver (Casino), and G. P. Collins (Fairy Hill).

The successful plots were sown in co-operation with the following farmers:—

- R. W. Hindmarsh, "Wiaraga," Bellingen.
- E. A. Amps, "Goldsborough," Camira Creek.
- (Mrs.) F. Johnson, Condong.
- M. McBaron, "Riverview," Raleigh.
- E. A. Green, "The Risk," Kyogle.
- G. Long, "Glengarry," Tatham.
- S. Dawson, Burrapine, Nambucca River.
- Wm. Barnes, "Heatherdene," South Woodburn.

The Season.

Generally speaking, the season was one of the worst ever known on the coast. Abnormally heavy rains were experienced in the spring, and the season gave every promise of being particularly good for the early-sown crops. November was very wet, with warm temperatures, and growth was luxuriant. December, however, was exceedingly hot and dry, particularly on the Clarence, where the majority of early crops were stunted, tasselled prematurely, and had to be fed off. Neighbouring river districts were rather more fortunate in that the crop did not fail absolutely, but the grain was badly pinched and yields were very much reduced. January rain was very excessive—22 inches on the Bellinger, 20½ at Dorrigo, 13 on the Nambucca, and 12 on the Tweed. The Richmond, on the other hand, averaged 4½

inches at Casino and Kyogle, but considerably more (10½ inches) at Woodburn, nearer the sea-board. February, in contrast with January and the normal fall for the month, was very low, but March was again wet, April still more wet, the rains culminating in the disastrous flood of mid-May, the commencement of a series of floods in all the coastal rivers, the highest being experienced on 22nd to 24th July.

Such an erratic season terminating in heavy flood rains had a disastrous effect on the maize crops. The late-sown crops suffered from the excessive rainfall in March and April, and yields were considerably reduced through lodging, resulting in mouldy grain. Harvest operations were very much hampered, and the crop was much longer in the field than usual and suffered, to an extent hitherto unknown on the coast, from the attack of the grain weevil (*Calandra oryzæ*) and angoumois grain moth (*Sitotroga cerealella*). This applied particularly to the early-sown crop. Unfortunately hundreds of acres of the late-sown crops were completely destroyed in the May and succeeding floods. Leaf blight was particularly severe in the early varieties, of which the sowing was delayed some weeks through inability to get the land in order.

The rainfall recorded at the above centres during the growth of the crop was as follows:—

—	Bellinger.	Camira Creek.	Kyogle.	Raleigh.	Tatham.	Condong.	South Woodburn	Burrapine.
Date of first record.	1st Nov.	10th Dec.	1s Nov.	4th Nov.	15th Dec.	6th Nov.	1st Nov.	13th Oct.
1920.	points.	points.	points.	points.	points.	points.	points.	points.
October ...	.....	.....	......	......	......	......	.....	380
November ...	613	......	811	626	......	339	818	338
December ...	167	75	330	184	60	672	303	283
1921.								
January ...	2,197	542	458	2,210	442	1,174	1,050	1,169
February ...	435	103	303	406	133	282	312	420
March ...	748	266	570	752	45	1,268	413	.....
April ...	......	505	......	......	489	......	......	......
May	......	......	......	......	94 (to 10th)	.....	......	......
Total ...	4,160	1,491	2,472	4,178	1,263	3,735	2,896	2,590

Details of Plots

Raleigh.—Soil alluvial; land first broken up two years ago; sown with oats March, 1919, maize November, 1919, and winter fodders May, 1920; maize experiment plots in November. Ploughed after fodders 23rd October and later harrowed, disced, cross-harrowed, and (just prior to sowing) rolled and harrowed. Drills 3 ft. 6 in. apart; seed planted with dropper at the rate of three grains every 3 feet. Varieties manured with P.B.5 (containing water-soluble phosphoric acid 6 per cent., nitrogen 4·3 per cent., potash 2·4 per cent.) at the rate of 1 cwt. per acre. The rainfall of 41·78 inches was much in excess of requirements, and, as the site was low-lying, crops suffered considerably.

Results of Variety Trials.

	Raleigh.	Condong.	Bellingen.	South Woodburn.	Tatham.	Kyogle.	Burrapine.	Camira Creek.
Date Sown.	4th Nov.	5th & 6th Nov.	2nd Nov.	1st Nov.	15th Dec.	8th Nov.	13th & 14th Oct.	10th Dec.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Ulmarra White-cap	93 36	79 11	...	...	35 8	47 0	44 30	.
Leaming	84 0	74 37	45 28	56 48	43 0	43 24	...	51 24
Fitzroy	85 20	82 28	86 28	65 40	61 28	57 22	48 32	50 0
Golden Nugget	80 18	...	...	57 32	...	...	43 20	55 40
Yellow Hogan	72 30	56 32	75 0		44 36	49 40	50 52	...
Giant White	69 16	...	76 8	64 24	34 32	48 18	36 18	...
Golden Beauty	65 24	70 40	83 10	...	39 46	50 0	61 0	...
Large Red Hogan	63 18	85 14	...		33 0	51 45	37 30	...
Hickory King	61 38	65 35	44 0	68 0	...	...	...	58 40
Manning Pride	57 42	71 38	...	...	32 0	48 32	41 0	...
Cocke's Prolific	...	73 30	...	...	20 28	44 6	42 0	...
Gold Standard Leaming	...	61 0	...	...	...	...	...	...
Craig Mitchell	...	...	48 34	...	...	...	...	...
Wellingrove	...	...	...	35 28	...	...	...	...
Iowa Silvermine	...	...	...	59 32	...	...	...	32 48
Boone County White	...	...	...	...	22 15	55 18	46 48	...
Macleay Golden Superb	...	...	...	48 16	...	...	...	...
American Golden Superb	...	...	...	42 48	...	...	...	48 40
Funk's Yellow Dent	...	...	...	49 8	...	...	...	...
Eureka	...	...	...	42 0	...	...	...	52 48
U.S. 133	...	...	...	28 8	...	...	...	37 8
Silver King	...	...	...	58 8	...	...	...	30 16
Yellow Mastadon	...	...	...	...	...	38 28	...	...
Early Clarence	...	...	...	...		24 28	...	...
Leggett's Pride	...	...	...	...	...	...	...	38 32

Results of Manurial Trials.

	Bellingen.		Raleigh.		Camira Ck.		Tatham.	
Variety Sown	Leaming.		Leaming.		Hickory King.		Fitzroy.	
Date Sown	2nd Nov.		3rd Nov.		10th Dec.		15th Dec.	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Superphosphate, 140 lb. per acre	52	50	89	36	45	40	40	24
Superphosphate, 280 lb. per acre	53	40	87	20	61	24	45	38
*M7, 182 lb. per acre	60	39	93	0	57	8	48	20
*M6, 224 lb. ,,	48	0	78	12	62	48	42	0
*P7, 252 lb. ,,	25	35	69	38	64	16	51	30
P7, 134 lb. ,,	26	38	84	54	60	0	47	0
*M9, 224 lb. ,,	29	26	84	24	61	0	52	40
No Manure	41	0	86	18	21	24	44	12

* The fertiliser mixtures are made up as follows:—M6, five parts superphosphate and three parts chloride of potash; M7, ten parts superphosphate and three parts chloride of potash; M9, three parts superphosphate, three parts bonedust and four parts chloride of potash; P7, equal parts of superphosphate and bonedust.

Condong.—Soil alluvial, typical of Tweed River banks; previous crop, winter fodders; thoroughly ploughed and harrowed twice; rolled once, an interval of eight weeks separating the two ploughings; seed dropped by hand in drills 4 ft. 6 in. apart and covered with harrows. Germination excellent; scuffled 23rd November; hilled 11th December. Harvesting delayed owing to unsuitable weather, and yields of early varieties reduced by weevil attack.

Bellingen.—Soil alluvial; ploughed twice and harrowed several times; tilth satisfactory; previous crop, maize unmanured; drills (4 feet apart) made with slide marker; seed sown with dropper and fertiliser dropped by hand; Leaming in fertiliser trial dropped at the rate of three grains every 20 inches; scuffled twice and hilled. Germination excellent and subsequent growth luxuriant. When mature, Fitzroy and Yellow Hogan averaged 14 feet high, Golden Beauty and Giant White 13 feet, and Craig Mitchell and Hickory King 9 feet. Harvesting was delayed until the end of June, owing to rainy conditions. From sowing to harvesting nearly 80 inches of rain were recorded, including 25·94 inches for May, when the first flood was experienced. Yields were considerably reduced by lodging, mouldy ears, weevil and moth attack.

Variety Trial with Maize at Camira Creek.

On grey sandy soil. Golden Nugget yielded 55 bushels 40 lb.

South Woodburn.—Soil light, sandy loam of poor fertility; previous crop, maize; soil in good tilth; ploughed three times and harrowed several times; drills 4 feet apart; seed dropped by hand at the rate of two or three grains every 3 feet; all varieties manured with P7 at the rate of 2 cwt. per acre. The rainfall (28·96 inches), although above normal, did not adversely affect this crop, owing to the sandy nature of the soil. The yields were the highest ever obtained by the experimenter, and were exceptionally good for the exceedingly poor class of soil. U.S. 133 and Wellingrove suffered from the attack of bandicoots, owing to earliness and lowness of cob on the stalk.

Kyogle.—Soil rich alluvial; previous crop, maize; land ploughed twice, harrowed three times; sown 8th November in drills 4 ft. 3 in. apart at the

rate of three grains every 2 ft. 6 in. Germination satisfactory; after-cultivation consisted of scuffling twice and hilling with disc hiller. The yields were very low indeed for this farm, owing to the excessive moisture when the plants were young, the dry spell at the tasselling period, and the continuous wet weather from February delaying harvesting some months, and resulting in very considerable loss through depredations of grain weevil and moth.

Burrapine.—Alluvial loam; previous crop, maize; soil reduced to a good tilth by early ploughing and a second ploughing a week previous to sowing; drills, 4 feet apart; seed dropped by hand at the rate of three grains every 2 ft. 9 in. and covered with Planet Jr.; sown 13th and 14th October. Strong winds tangled the crop considerably and caused the ears to mould badly by coming in contact with the moist ground. Grain weevil was also very bad in this locality.

Manurial Trial with Maize at Camira Creek.

	bus.	lb.
Manured with P7 at 252 lb. per acre	64	16
No manure	21	24

Tatham.—Soil, alluvial loam, typical of best soil of Richmond around Casino; previously down to winter fodders; ploughed twice at an interval of six weeks, rolled, and harrowed; sown with dropper 16th December in drills 4 feet apart at the rate of three grains every 3 feet; manure sown by hand. Germination good; scuffled twice and hilled. The rainfall was very erratic, 12·63 inches falling during the growth of the crop from sowing to 10th May, while on 15th and 16th May flood rains fell, 10·49 inches being recorded. This and subsequent heavy falls prevented harvesting and caused lodging and mould, which, with a check through dry, hot weather in December immediately after sowing, and attacks of leaf blight in the earliest varieties, considerably depleted the yields.

Camira Creek.—Soil sand, very poor, but moist and in good condition at planting time; previous crop, maize; land ploughed four times and harrowed frequently; drills 4 feet apart; seed dropped at the rate of two grains every

2 feet. Varieties fertilised with superphosphate at the rate of 182 lb. per acre; seed and fertiliser covered by harrows. Germination excellent and subsequent growth very satisfactory. The effective rainfall (14·91 inches) was distributed satisfactorily, except during February. The early varieties suffered from leaf blight, which was only to be expected when sown so late in the season. The yields of Hickory King are high for the locality. The difference of nearly 43 bushels between the plot manured with 24 cwt. P7 and the unmanured plot is a powerful argument in favour of fertilisers in poor, sandy country.

Summary.

A season marked by such abnormally high precipitation and, in consequence, by particularly severe attacks of insect pests and fungus disease, is not productive of accurate experimental data, owing to the irregularity of the results. Varieties which usually yield well have not given good returns this season. It is interesting to note, however, that the variety Fitzroy (formerly Improved Yellow Dent), which has given remarkably consistent results in trials on the coast ever since its introduction, has this season (probably the wettest in its history) occupied first place at three of the six centres, second place at one, and third place at two, each centre being typical North Coast maize land. Other varieties which yielded well are Ulmarra White-cap, Yellow Hogan, Golden Beauty, Leaming, and Large Red Hogan. The value of Hickory King on poor, sandy soils is again demonstrated in the trials at South Woodburn and Camira Creek.

The manurial trials gave rather contradictory results, and only in one case gave largely increased yields over unmanured with all fertilisers. The mixture M7, which contains half the potash of M6, and which is therefore much cheaper, gave decidedly increased yields over the latter, except in one centre. In all cases the addition of 42 lb. of potash per acre gave substantial increases, represented by the difference between superphosphate 140 lb. per acre and M7, 182 lb. An extraordinary feature of the results is the failure of P7 on the Bellingen, where it has previously done remarkably well. The falling off is no doubt due to some seasonal influence.

Central Coast District.

J. M. PITT, Assistant Inspector of Agriculture.

The number of farmers co-operating with the Department in carrying out maize tests in this district was slightly in excess of the previous season. They were :—

J. G. Perrett, Miller's Forest, Hunter River.
John Lawson, Hinton, Hunter River.
W. Smith, "Bona Vista," Paterson.
Alex Smith and Atkins Bros., Bandon Grove, *via* Dungog.
R. Richardson, Mondrook, Manning River.
H. Flett, Taree, Manning River.
A. Longworth, Ghinni Ghinni, Manning River.
A. Norris, Mt. George, Manning River.
E. L Andrews, Mt. George, Manning River.
John Booth, Temagog, Macleay River.

Whilst farmers' experiment plots have been instrumental in introducing into the rich coastal areas some of the best known and heaviest yielding varieties, the recent inauguration of the maize-growing competition will prove much more valuable and interesting to maize growers. This has already proved the case along the Manning River, where the first contest (to decide who had the heaviest yielding variety or strain in the district) took place last season. The winning entry, the variety Fitzroy (formerly known as Improved Yellow Dent, historically connected with Grafton Experiment Farm, and yielding well in farmers' plots), is becoming increasingly popular throughout the coast, chiefly owing to its all-round capabilities.

Another innovation is the establishment of pure seed plots. Many farmers prefer to grow one variety pure, rather than conduct variety trials, owing to the pollination that is liable to occur in the latter instance. There is, too, a keen desire for pure seed. The Department supplies pure seed to suitable growers, nearly a score of whom are conducting seed plots this season, and this is going to have most beneficial results.

Owing to a most favourable season, the yields throughout were excellent, those at Ghinni Ghinni probably being a record for farmers' experiment plots for the central coast. Sown early on rich, new land, five of the nine varieties tried topped the 100-bushel mark, the most noteworthy performances being 144 bushels from Red Hogan, and 124 bushels from Funk's Yellow Dent. The latter is an early maturing variety, mentioned in last year's report as likely to become extremely popular on the central coast. Fitzroy and Leaming—amongst the Department's first four recommendations—also yielded well. Yellow Hogan, a variety grown largely along the Macleay, was second only to Red Hogan in the trials. Although not giving the rank growth of the latter, nor producing such a large cob, it is a wonderfully good bag-filler, and has a very small core. Manning Pride, which has only recently been included in the trials, from the Upper Manning, also yielded prominently. Of the very early varieties, Craig Mitchell, a well-known white Victorian variety, gave promising results. It matures well under five months and produces a large cob.

Considering that such moist conditions prevailed throughout the growing period, the crops were remarkably free from fungus diseases. Insect pests, however, were troublesome, especially at Ghinni, where the tips of the cobs were considerably eaten by grubs. Weevil was present in the early sown plots. Farmers do not trouble to combat this pest in, or round about, the barn, and old weevily maize and other litter is allowed to accumulate and to form a hatching ground for the weevil. The removal of all cover and spraying with some suitable insecticide is strongly recommended.

Another pest—and one that is becoming increasingly troublesome each year—is the ordinary black and white magpie. The bird attacks the maize (chiefly in the Mt. George region) at two stages, viz., when the young plants are showing through, the plant being followed down with the beak and the grain secured; and again when the grain is ripening on the stalk.

Cultural Notes.

Miller's Forest.—Heavy loam soil. In 1918 land under millet, and in 1919–20 under potatoes followed by turnips. Ploughed in September; harrowed and rolled. Approximately 46 inches of rain fell during the growing period and the yields under the circumstances are good.

Variety Trial with Maize at Ghinni Ghinni.
This crop of Large Red Hogan yielded 144 bushels 11 lb. of grain per acre.

Hinton.—Floods destroyed the plots.

Paterson.—Sandy soil; the hillside soils around Paterson are noted for their fertility. In 1919 land under Sudan grass; ploughed and left in

fallow; ploughed just previous to sowing in September. On river flat land tomatoes were grown in 1918, pumpkins in 1919. Ploughed in autumn and again prior to sowing.

Bandon Grove.—New land, previously under paspalum; ploughed several times and otherwise cultivated to break into fine tilth; loamy soil.

Mondrook.—Maize grown several years previously on the land; disc-ploughed and rolled: heavy loamy soil.

Results of Variety Trials.

	Mt. George (E. L. Andrews).		Ghinni.		Miller's Forest		Bulliac.		Paterson.		Temagog.		Mondrook.		Taree.	
Date of Sowing	27th Sept.		29th Sept.		17th Nov.		24th Sept.		20th Sept.		1st Sept.		22nd Sept.		15th Oct.	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Farmer's Variety	100	9*	....		....		....		....		77 / 78	9* / 1	....		....	
Fitzroy	94	14	90	6	83	2	91	19	76	34	89	48	70	0	....	
Manning Pride . .	83	50	110	51	74	16	....		....		....		69	46	....	
Golden King	91	19	....		....		....		....		....		....		....	
Ulmarra Whitecap	88	18	....		....		....		....		....		66	14	....	
Large Red Hogan . .	97	11	144	11	125	40	....		75	25	87	41	67	28	....	
Early Clarence . ..	53	3	....		....		....		....		....		....		....	
Yellow Hogan	103	7	108	8	80	0	....		....		....		64	46	....	
Golden Beauty	86	44	102	34	54	16	78	18	....		71	36	67	28	....	
Golden Nugget . .	97	11	76	14	....		....		....		66	21	67	48	....	
Leaming	106	6	87	19	77	8	75	30	76	34	....		65	20	....	
American Superb	69	12	....		....		....		17	38	....		....		....	
Funk's Dent	....		124	44	....		72	46	35	20	....		....		....	
Golden Superb .. .	....		95	37	....		72	10	....		....		....		....	
Wellingrove	....		....		....		77	16	56	0	....		....		....	
Eureka	....		....		....		....		44	11	....		....		....	
Craig Mitchell	....		....		....		....		55	55	....		75	50	61	22
Cocke's Prolific	....		....		....		....		....		....		47	28	....	
Boone County . ..	....		....		....		....		....		....		58	42	78	18
Manning White .. .	....		....		....		....		....		....		63	12	84	12
Iowa Silvermine .	....		....		....		....		....		....		....		53	16
Hickory King.. . ..	....		....		....		....		....		....		....		60	23
Silver King	....		....		....		....		....		....		....		65	26

* At Mt. George the Farmer's Variety sown was a Dent, and at Temagog the two varieties were Hawkesbury Hogan (77 bus. 9 lb.), and Macleay Beauty (78 bus. 1lb.).

Manurial Trial at Mount George (A. Norris).

	bus.
No manure	50
210 lb. M5	75·7
224 lb. M6	42·40
140 lb. superphosphate	60·22

M5 mixture consists of two parts superphosphate and one part sulphate of ammonia, and M6 of five parts superphosphate and three parts chloride of potash.

Taree.—Land previously under vegetables and under maize in 1919; ploughed in winter of 1920, and again before sowing; only white varieties sown. Silver King, a very early maturing variety, showed excellent qualities for cow fodder.

Ghinni Ghinni.—Heavy loamy soil; old paspalum paddock; ploughed mouldboard; disc-harrowed cross, three times; disc-ploughed and disc-harrowed several times. Seed-bed rough and grassy. Magnificent growth throughout.

Mt. George (Mr. Norris).—Loamy soil; maize grown in 1919-20; disc-ploughed 12 in.; harrowed and rolled; magpies did considerable damage here.

Mt. George (Mr. Andrews).—Loamy soil; pumpkins in 1919; disced and disc-ploughed in early August, and again in September; harrowed and rolled.

Bulliac.—Loamy soil; previously pasture; maize was grown in 1919; ploughed in early June, disc-harrowed twice and tine-harrowed once.

Tenagog.—Rich loamy soil; maize grown for many years previously; stalks burnt off; ploughed in September and again before sowing, and then harrowed.

The Distillation of Mint Oil

Information as to the best type of still to use for the extraction of the oil from mint and peppermint was lately compiled from United States literature, in response to a correspondent's request, and may be of interest to others

A mint-still consists of two or more large vats or tubs, into which the mint hay is put to be steamed, a boiler to generate the steam, a condenser or worm to condense the mint vapour and steam as it comes from the vats, and a separator to separate the mint oil from the water. In the majority of stills there are either two or four tubs arranged about a crane, which is used to lift the heavy lids of the tubs, and also to lift out the steamed hay after distillation. The tubs are of wood or galvanised iron. In the larger stills, the tubs are 9 feet deep, 8 feet diameter at the top, and 7 feet diameter at the bottom. Heavy lids are clamped down, making the vats steam-tight.

Before filling the tub, an iron rack to which chains are attached is lowered to the bottom of the tub, and the chains are hooked within reach on the inside of the tub. The cured hay is unloaded into the tubs, and tramped down until they are properly filled. While this is being done, steam is passed into the tub from below to start the "cooking" process, and to aid firm packing. As soon as the tub is filled, the lid is clamped on tightly, and the mass of hay is subjected to the steaming process, which vapourises the mint oil, so that it passes out of the outlet pipe at the top into the condensing coil. The steaming process is continued until no odour of mint remains in the vapour, which is ascertained by opening the bung in the lid and smelling the vapour. The hay is then removed from the tub in one operation by means of the rack already mentioned.

When mint hay is dry and well cured, from 25 to 40 minutes are required to distil a charge, but when damp and poorly cured it sometimes requires two hours or more. This is why hay is dried in swath before distilling.

The condensing coil or "worm" is 5 inches in diameter where the steam enters, and it decreases in size until 2 inches in diameter at the outlet. Cold water trickles over the coil from a perforated trough placed above it, and as the vapour condenses it runs into the separator, which consists of a galvanised iron barrel with an open top. The water settles on the bottom, and the oil rises to the top, and between the two a layer of yellowish spongy scum forms. The water is drained off from below, and the oil from above, and it is then put into galvanised-iron drums, which are sealed tightly.

A pressure of 60 to 80 lb. is usually maintained in the boiler, although in most cases a reducing valve is used to reduce the pressure to 30 lb. as it enters the tub. The yield varies from 25 to 80 lb. of peppermint oil per acre, with an average of 40 lb. per acre. Spearmint as a rule yields slightly less.—A. J. Pinn, Inspector of Agriculture.

The Effects of Feeding Sudan Grass to Stock.

Some Experiments and Conclusions.

S. T. D. SYMONS, M.R.C.V.S., Chief Inspector of Stock.

The Genesis of the Investigations.

In February, 1920, sickness associated with feeding on Sudan grass was reported by Mr. A. N. Shepherd, Inspector of Agriculture, as occurring among horses on the Irrigation Areas at Leeton. The horses were reported by the investigating veterinarian to be suffering from polyuria, the urine being thick and turbid, the hindquarters weak, the joints swollen, and inco-ordination evident, and the opinion was expressed that long-continued feeding on Sudan grass without change of feed was responsible for the sickness. The grass was ripe, seeding, and ready for cutting.

The horses were removed from the Sudan grass and fed on chaff and bran and natural pastures, and no further cases occurred, while of those affected all recovered except five, which showed chronic symptoms. These animals, twenty in number, were taken off natural pastures and put straight on to the growing Sudan grass. About ten days later one was found dead, and two days afterwards another was down with colic, but recovered under treatment; this animal was put into the paddock, but died after three days. Within a fortnight six horses died and six were badly affected. Mr. C. L. O'Gorman, M.R.C.V.S., saw four of these affected animals twelve months after they became affected, and reported them to be still showing marked muscular inco-ordination of the hind part and incontinence of urine, which was turbid, and left thick deposits that caused soreness. The horses were seen again six months later and the above symptoms were still in evidence, although the animals were in excellent condition. It is doubtful if these horses will recover. Cattle feeding at the same time in the same paddock were not affected.

In December of 1920 a report was received from the veterinary officer of the Irrigation Area that about thirty head of heavy draught horses that had been fed for some time on oaten and wheaten chaff and oats were suddenly fed, without his knowledge, with large quantities of Sudan grass chaff. After two days' feeding, many (75 per cent.) were noticed to be off colour and suffering from colic in varying degrees. After two days' treatment much improvement was noticed, and by the sixth day all with the exception of three were cured. Two of these three were cured on the eighth day. The remaining one suffered from recurrent spasmodic colic, and died on

the fourteenth day, a post-mortem revealing enteritis, colitis, and peritonitis. As soon as the horses were noticed to be sick the Sudan grass chaff was withdrawn and oats and wheaten chaff given instead, when no further cases occurred. The veterinary officer attributed the trouble to injudicious feeding.

Nature of the Experiments.

Following on these reports, it was decided to carry out definite feeding experiments with Sudan grass, and to collect information on the subject of its possible poisonous properties. The managers of the various experiment farms were asked to provide facilities for feeding on Sudan grass, with the following results:—

Nyngan.—No Sudan grass was available at this farm, but it has been extensively grown and fed, and no illness in stock as a result has been recorded.

Yanco.—On 5th May, 1920, two mares were selected for a feeding experiment. The grass then was the third growth and the seed nearly ripe: several severe frosts had dried off the heads and made the grass less sappy than it had been. During the later period of growth the weather was very dry, and latterly cold and frosty.

Both mares were in good health when Sudan grass feeding was started, but low in condition. They improved fast, but as time went on the feed became less palatable and the heads were eaten off first. The grass was cut for the animals and they got approximately 120 lb. a day between them, and nothing else except water. Feeding was continued up to 30th May, and no symptoms of digestive, urinary, or locomotary derangement was shown, nor any other symptoms of ill health.

Cowra.—On 10th May, 1920, a horse was turned out to graze on Sudan grass, which was in head with young growth showing at the butts. The grass had been touched by frost. The horse was kept on it until 31st May, by which time the grass was eaten out. The manager reported that no other food was given to the animal, that no ill-effects were noticed, and that he improved in condition.

Leeton (Murrumbidgee Irrigation Areas).—The following experiments were carried out under the supervision of Mr. B. C. Veech, the veterinary officer to the Irrigation Commissioners, and Mr. A. N. Shepherd:—

1. In January, 1921, two horses that had been running for three months on natural pastures were brought in and fed on oaten chaff (18 lb.) for two days. They were then put into a paddock of Sudan grass about 5 feet high, on 17th January. The grass was in the flowering stage, but the seed matured rapidly. The first day the animals were allowed to remain on the grass for two hours, on the second day for four hours, on the third day for eight hours, and on the fourth and subsequent days were allowed to remain in the paddock all the time. On the first, second, and third day they also

received an oaten chaff ration (6 to 10 lb.). The horses were run on this paddock, receiving no other feed until 15th February (twenty-eight days). No ill-effects were observed.

2. A portion of the second growth of the crop previously used was fenced off, and the same two horses put on it on 22nd February, and kept on it until 18th March, except for two days (4th to 6th March). They received no other food and remained in good health, improving in condition.

3. Two horses were fed from 22nd March to 29th April on Sudan grass chaff made from the previous year's hay. Both had slight attacks of colic, which yielded to treatment; otherwise they remained in perfect health. They received from 15 to 18 lb. per day each, but lost a little condition.

4. On 30th April the horses were allowed to graze on Sudan grass 2 feet high for two hours, and were then removed and fed Sudan grass chaff (12 lb.). On 1st May they were allowed to graze for four hours and then fed Sudan grass chaff (10 lb.) From 2nd May to 7th July they were grazed wholly on Sudan grass. No evidence of disease except for the slight attacks of colic noted were seen at any stage, yet for over six months these horses had practically nothing to eat but Sudan grass in some form or other.

As regards the growing of the grass for the experiments enumerated above, the Chief Inspector of Agriculture reports that it was sown in the spring of 1920, similar methods being adopted in its sowing and cultivation to those under ordinary irrigation conditions. The grass made good growth, and owing to the favourable circumstances irrigation was unnecessary. He also reports the experience of five farmers at Leeton and Griffith who grew Sudan grass at the same time and fed all classes of stock on the crop, as both green grass and hay, without ill results. On one farm the grass was made into silage and fed to milking cows, with very satisfactory results.

Hawkesbury Agricultural College.—The following experiments, supervised by Mr. F. Whitehouse, B.V.Sc., were held here:—

1. An aged mule was fed dry Sudan grass chaff, which was very withered, hard, dry, and unpalatable, and contained hard seed. She ate from 14 to 22 lb. (averaging 18·6 lb.) daily for fifteen days, from 20th January, 1920.

2. The same animal was fed later for thirteen days on green Sudan grass chaff cut at the flowering stage. It was succulent, soft, sappy, and palatable. She ate from 18 to 35 lb. (average 28·3 lb.) daily.

No other food was given in either experiment. During the experiments the animal lost condition, but she was very old and was suffering from an abscess in the girth region and purulent inflammation of the coronets. She showed no symptoms which could be attributed to feeding on Sudan grass.

In addition to foregoing experiments, inquiries were made from inspectors of stock stationed in different parts of the State, but no further cases of alleged poisoning by Sudan grass were reported.

Chemical Investigations.

The departmental Chemist, Mr. F. B. Guthrie, has examined several specimens of Sudan grass for prussic acid, with the following results:—

1. An unsatisfactory sample, very dry, and consisting chiefly of the lower part of stems from which the tops had been eaten; forwarded from Leeton, March, 1920. Presence of prussic acid indicated by some tests.

2. Forwarded from Yanco Experiment Farm, May, 1920. (*a*) Immature head; prussic acid absent. (*b*) Immature grass; prussic acid ·005 per cent., equal to ·007 per cent. calculated on the material dried at 100°C. (*c*) Mature grass; prussic acid not detected in leaves and stems.

Other Records.

Dr. G. P. Darnell-Smith, Biologist to the Department, draws attention to the fact that in the *Journal of Agricultural Research*, Vol. xviii, No. 8, January, 1920, Menaul and Dowell have recorded the occurrence of cyanogenesis in Sudan grass and mortality in cattle while pasturing on the grass. They state also that the quantity of hydrocyanic acid present is greatest in the young plant, and decreases rapidly as the plant matures.

In U.S. *Farmers' Bulletin*, No. 1126, three cases of prussic acid poisoning of cattle by Sudan grass are recorded, and a warning is issued that similar care to that taken in regard to sorghum feeding may be necessary in some districts in regard to Sudan grass.

Conclusions.

A perusal of the foregoing matter makes it clear that the conditions investigated fall under three different headings, thus:—

1. *Poisoning by Prussic Acid.*—Owing to the close relationship of Sudan grass to the sorghums, it was only natural that the subject of prussic acid should be raised when poisoning by Sudan grass was referred to, but the clinical history, both of the first mortality in February, 1920, and the outbreak of colic in December, completely negatives the idea that prussic acid was concerned. On the other hand, the investigations of the departmental Chemist, confirming as it does American reports, make it evident that prussic acid poisoning by Sudan grass is a possibility. This fact, however, should no more prevent farmers growing Sudan grass than it prevents them growing sorghum, as a few simple precautions will safeguard them from loss. Farmers should remember:—

(*a*). Sudan grass is most likely to be harmful to cattle when immature or stunted through drought.

(*b*). If cattle are put on to Sudan grass, care should be taken that at first they are only put on to it for a short time.

(*c*). When cut and dried it is very unlikely to be harmful.

(*d*). So far as prussic acid is concerned, it may safely be grazed by horses or pigs, and is unlikely to be as dangerous to sheep as to cattle. It is only on isolated occasions that sufficient prussic acid will be present to make the grass harmful.

2. *Ill-effects resembling Millet Poisoning.*—The mortality of February, 1920, was apparently due to the Sudan grass, and in some of the symptoms it shows a resemblance to millet poisoning. It is evident, however, from the results of the experiments recorded and the inquiries made, that the cases were altogether exceptional. The only conclusion that can be drawn is that there occurred at that time some circumstance, or set of circumstances, not usually obtaining, that rendered the grass toxic. This mortality should not deter farmers from growing Sudan grass, since nearly all the common fodder plants may at times be responsible for deaths in stock. Maize, for example, when affected with certain diseases, has been responsible for heavy mortality.

3. *Death from Colic.*—This, of course, is an aspect entirely unrelated to either of the foregoing, the fatalities being simply due to the sudden change on to Sudan grass chaff. All hard feed is liable to cause extensive outbreaks of colic if large numbers of horses are suddenly put on to it, and even if Sudan grass is looked on as more likely to cause such trouble than some other foods, prevention is easy. Farmers should take care not to place horses suddenly on a heavy ration of Sudan grass chiefly, but to bring them on to it gradually, and to utilise it in conjunction with other foods.

THE CULTIVATION OF LAVENDER.

LAVENDER for commercial purposes is propagated from cuttings, 4 to 5 inches long. Plants may also be raised from seed, but this system is not recommended, as the seedlings vary considerably in character—early and late, tall and dwarf. The best kind of lavender to grow is *Lavendula vera,* and the soil should be a sandy loam. The plant grows under almost any soil conditions, but when oil extraction is the grower's object a suitable soil is essential; if lavender is grown on strong or rich ground the product is coarse. Land altogether too poor for ordinary farming answers well.

The ground should be ploughed to a depth of 7 to 8 inches and thoroughly worked before planting takes place. The plants are set 4 feet apart in rows 5 feet apart, and the crop harvested when the plant is in full bloom, the essential oils being obtained from the flowers and stems.

It may again be pointed out to readers of this journal that owing to the supplies from oversea countries of cheaper production becoming normal, and to the fact, moreover, that most of the oils and perfumery produced can now be manufactured synthetically, the cultivation of such crops as lavender for their essential oils cannot be regarded as a dependable occupation, except as a side-line, for any but the experienced and expert.—E. N. WARD, Superintendent, Sydney Botanic Gardens.

A FREQUENT cause of crippled chickens from eggs hatched in incubators is carelessness in regard to the incubator temperature. Very high temperatures are more often responsible than low ones, but any circumstance that tends to weaken the embryo is likely to cause cripples. Too close inbreeding is a more prolific cause of crippled chickens even than that mentioned.—JAMES HADLINGTON.

Fungicidal Dusts for the Control of "Smut."

G. P. DARNELL-SMITH, D.Sc., F.I.C., F.C.S., Biologist.

In the *Experiment Station Record*, United States Department of Agriculture, Vol. 44, No. 4, March, 1921, there appears a summary of the work carried out by W. Mackie and F. N Briggs ("Science" n. ser. 52, 1920, No. 1,353). After calling attention to the injury to seed grain from the customary treatment with formaldehyde and copper sulphate solution, which injury is said to be greater in arid regions than in humid ones because of the more frequent rupturing of the seed coats of the grain during thrashing, the authors give an account of experiments with Little Club wheat treated with solutions and dust-preparation of fungicides. The experiments were repeated from two to nine times, and the average effect on germination and smut occurrence was tabulated. The grain was treated with formaldehyde, copper sulphate, and copper sulphate and lime solution, and with dust-preparations of copper carbonate, copper sulphate, copper sulphate and calcium carbonate combined, and copper sulphate and lime dusted separately. Two oz. of the dust per bushel of seed were required.

Row plantings were made, the seed was harvested and thrashed, and the percentage of smut determined. Very favourable results were obtained by the use of the dust-fungicides. Copper sulphate dust when mixed with equal parts of calcium carbonate controlled smut attacks due to seed-borne spores, without damage to germination. Copper carbonate dust was equally effective. The dusts were all said to adhere well to the grain.

The results of the experiments recorded in the *Agricultural Gazette* of New South Wales, March, 1917,* are thus confirmed. The results of further experiments on the use of copper carbonate as a bunt or smut preventive were published in the *Agricultural Gazette* in October, 1919.† In a valuable and stimulative criticism of this article in the *Journal of Agriculture* of South Australia, November, 1919, Professor Arthur J. Perkins, says :—

"It must be assumed that copper carbonate, besides its harmlessness in relation to germination, has also high fungicide powers in relation to bunt spores. Unfortunately, this point is not made very clear by the writers, and, in view of the very low solubility of copper carbonate, it is a point that cannot be lost sight of. We cannot, for instance, imagine that a substance wholly insoluble in water can have high fungicidal powers. The statement, too, that the faulty germination of seed sown under dry conditions can, in most cases, be traced directly to the injurious effects of bluestone solution, unless qualified, is very much open to question."

* "The Prevention of Bunt"; G. P. Darnell-Smith, *Agricultural Gazette*, New South Wales, March, 1917.

† "A Dry Method of Treating Seed Wheat for Bunt"; G. P. Darnell-Smith and H. Ross, *Agricultural Gazette*, New South Wales, October, 1919.

In dealing with this criticism, I shall have to refer to the valuable work of Spencer Pickering at Woburn upon the constitution of Bordeaux mixture, and of Clark upon the lethal strength of copper compounds. In his researches upon Bordeaux mixture, S. Pickering has shown* that, in the preparation of this useful fungicide, when lime is added to a solution of copper sulphate a series of different compounds (basic sulphates) is formed according to the proportions taken. But, when these are sprayed upon leaves and exposed to the air, a change takes place: "The ultimate form of deposit on the leaves is, in all cases, copper carbonate. With Burgundy mixture, it is the carbonate itself which is applied; with Bordeaux mixture, the carbonate is formed *in situ* from the decomposition of the sulphates."

We know that calcium carbonate is practically insoluble in water, but we know that by the action of carbonic acid gas it is converted into calcium bicarbonate which is soluble.

It was this that first led me to try the effect of copper carbonate as a fungicide. Normal carbonate of copper is incapable of existing, but there was reason to suppose that the carbonic acid or other substances in the earth might render the copper carbonate of commerce more or less soluble. Experiments indicate that this takes place. A reaction between an insoluble solid outside the walls of fungus spores, with the contents of those spores while still enclosed within the walls, is a chemical impossibility; either the copper of the fungicide must be soluble, and penetrate into the spore, or the contents of the spore must come out, and in some way render the copper compound soluble.

In 1902, J. F. Clark published (*Botanical Gazette* 33, page 26) an important paper dealing with various fundamental aspects of fungicidal action. Though the lethal strength varied from 0·005 to 0·00025 per cent. of copper—a twenty-fold variation—in the majority of cases it approximated to 0·0015 per cent., and this lethal dose was the same in whatever form the copper was supplied, viz., as sulphate, chloride, nitrate, acetate or formate. "The efficiency of a fungicide in actually killing the fungus, or in preventing the germination of its spores, appears from Clark's work to be simply a question of the amount of soluble copper present; and, in the case of every copper fungicide known, there is, either initially or after it has been subjected to the action of the air, sufficient soluble copper to kill the spores of most fungi."*

One of the most insoluble carbonates of copper is malachite. Its solubility varies from 0·0008 per cent. copper in pure water to 0·006 per cent. in water saturated with carbonic acid gas, so that, even with this compound, the solubility may exceed the average lethal strength of 0·0015 per cent. found by Clark.

If Pickering's contention that the ultimate form of the deposit upon leaves sprayed with Bordeaux mixture is copper carbonate is correct, the universal use of this mixture and its efficiency seem to place the fungicidal value of copper carbonate beyond doubt.

* "Science and Fruit Culture": Duke of Bedford and Spencer Pickering, published 1919.

As regards wheat injury from the customary treatment with copper sulphate solution to which attention was called,* this has been confirmed by the work of Mackie and Briggs.

The injury liable to be caused to seed wheat by pickling in bluestone is now beginning to be realised in England. In the *Journal of the Ministry of Agriculture* for February, 1921, Messrs. E. S. Salmon and H. Wormald, of the South Eastern Agricultural College, Wye, Kent, describes some experiments on the prevention of bunt in wheat. Summarising their investigations, they say: "There is reason to believe that the common practice of 'pickling' seed wheat in a 10 per cent. solution of copper sulphate (1 lb. to 1 gallon of water) as a preventive against bunt results in serious damage to the germination of the seed."

It is stated that, for this reason, the Ministry of Agriculture in its leaflet No. 92 recommends a weaker solution, even though it is known that, with this solution, the control of bunt is not so complete. A 10 per cent. solution of copper sulphate is far stronger than is ever recommended in New South Wales. Experimenting with solutions weaker than 10 per cent., Messrs. Salmon and Wormald found that a 1 per cent. solution of copper sulphate (1 lb. copper sulphate to 10 gallons of water) reduced the amount of infection, but was far less effective than a 2·5 per cent. solution of copper sulphate. A 2·5 per cent. solution of copper sulphate ($2\frac{1}{2}$ lb. to 10 gallons of water) reduced the amount of infection considerably, but was less effective than a 1·240 formaldehyde solution. It is not clear why control with these weaker strengths of copper sulphate was not obtained, since here we obtained control with a $1\frac{1}{2}$ per cent. solution.

The Good Name of the Bee.

"I READ with great interest your item in the October issue, 'Do Italian Bees Destroy Sound Fruit?' I have watched very carefully the actions of bees in this respect, and have found that plums like the Early Jewel and Shiro, when allowed to get over-ripe, burst on the side and the juices flow down the fruit, and that the bees, in the process of sucking up these juices, increase the size of the burst, but I am quite certain that they do not puncture the fruit. I have watched very carefully, too, the little birds we call 'silver eyes,' hopping about the ripe fruit while the dew is on it about sunrise, and puncturing it so as to make holes in it about the size of a pin. These holes the bees readily find, and through them suck the fruit juices. There is also the 'miner' (commonly called here the 'twitty-twat') doing the same damage, though I think only to very ripe fruit. The same bird is very hard on Thorny madarin in midseason in the same way. I think it would be a very bad mistake to convict our great friend the bee of the wrongs of others."—A. E. BEST, Middle Dural.

* "A Dry Method of Treating Seed Wheat for Bunt;" G. P. Darnell-Smith and H. Ross, *Agricultural Gazette*, New South Wales, October, 1919.

Cheesemaking on the Farm.

(Continued from page 740.)

J. G. McMILLAN, M.B.D.F.A., N.D.D., Dairy Instructor.

THE TECHNIQUE OF CHEDDAR CHEESEMAKING.

The cheesemaker's day practically commences with the treatment of the previous evening's milk, the care of which has already been dealt with. His first duty in the morning is to see that the milk is in good condition. Should too great an acidity be present, or be likely to result before the morning's milk can be added, it is probably as well to make the milk into cheese right away. This should be avoided as far as possible, however, for it means practically double the labour. If there is a marked tendency for it to become acid, do not add any morning's milk to the night's until just before renneting. If the necessary care has been taken, however, even in fairly hot weather this procedure should not be necessary, so we will presume that the cheesemaker finds the previous evening's milk in first-class condition.

The cream which has gathered on the surface should be carefully skimmed off into a bucket, heated to 120 deg. Fah., and then thoroughly mixed with several gallons of the morning's milk a few minutes prior to renneting. This allows of the butter-fat being more equally distributed throughout the curd. When the cheesemaker is dealing with only one milk, experience will teach him how it will work from day to day. He has a great advantage over his brother cheesemaker in a large factory with numerous suppliers, and ought always to produce a better article, because of the control he has over the milk from the time it is drawn.

Ripening of the Milk.

As already stated, a certain amount of acid must be developed in the manufacturing process to give the characteristic flavour, texture, and body to cheddar cheese. This development of acid must be done in only certain amounts at different stages—too much acid or too little will not allow of the production of good cheese. The maximum amount of acid developed in the curd is about 1 per cent.; if this amount was developed in milk it would become spontaneously thick and a cheese could not be made from it. There are three main stages at which a certain amount of acid should be developed. At renneting the milk should have an acidity of ·18 to ·2 per cent.; when drawing whey from curd ·18 to ·2 per cent.; and when salting curd ·9 to 1 per cent.

These degrees of acidity vary under certain conditions which may be further explained.

Practice has taught us that in the production of a choice characteristic cheddar cheese a certain time is necessary (about five and a half to six hours) from the time the rennet is added to the milk until the salt is applied to the curd. The time between the first and second stage—that is, from renneting to wheying off—should be about three hours, when the curd should be properly cooked. Between the wheying off and salting stages certain changes that give the necessary texture will have taken place. We also know by experience that acidity will develop much more quickly in milk than it will in the curd and whey stages, so that by waiting, say, half an hour for acid to develop in the milk the period of manufacture might be from one to two hours less than if one had renneted too soon. Further, experience has taught us that by having the right acidity and the right organisms present, the development of undesirable bacteria is checked. In fact, it might be safely said that the more acidity one can develop in milk (provided that it does not interfere with getting the curd properly cooked) the better chance one has of obtaining a good flavoured product. The whole secret of ripening lies in having the right kind of bacteria present and the development of these to a stage at which the exact amount of acid is present, so that a firm curd will be produced in three hours from renneting. Even clean milk will contain various kinds of bacteria, but the only kinds the cheesemaker desires are those that will produce a clean acid without the production of gas. Those we desire are the lactic acid bacilli. The number of bacteria in properly ripened milk is enormous, probably 1,500,000 per cubic centimetre (that is, per seventeen drops). If we had some means of rapidly counting bacteria, and we knew that 1,500,000 per cubic centimetre in the milk at renneting gave us good cheese in the proper time, then by simple regulation of measurements and temperatures the whole work could be regulated by the clock.

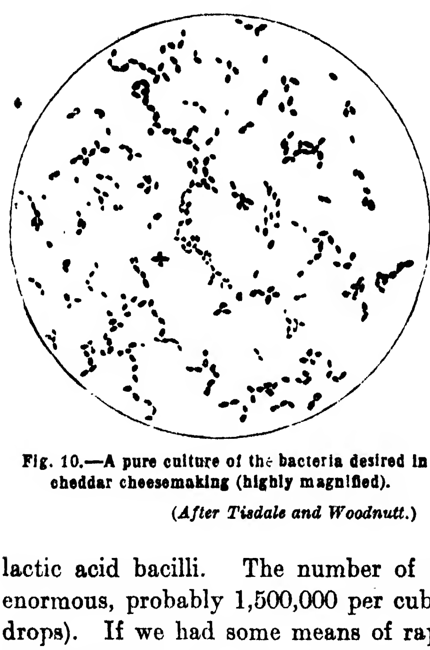


Fig. 10.—A pure culture of the bacteria desired in cheddar cheesemaking (highly magnified).

(*After Tisdale and Woodnutt.*)

Ripening of milk is done in two ways—naturally and artificially. Natural ripening is brought about by heating the milk to 86 to 88 deg. Fah. and maintaining it at that temperature until sufficient acidity has developed. The objections to this method are several—(1) work is unnecessarily delayed; (2) the fat is liable to rise during the process and it is difficult to thoroughly mix it with the milk afterwards, therefore there is a likelihood of loss being incurred; and (3) if undesirable bacteria be present these are likely to retard the development of those that are desirable, thus aiding in the production of

bad flavours. Ripening can be assisted by allowing the evening's milk to remain at a certain temperature that will assist bacterial action, but in a climate such as ours this practice cannot be recommended owing to the liability of the milk to be over-ripe by morning. Artificial ripening is brought about by adding either sour milk, whey kept over from the previous day, or a specially prepared starter. By using the first two there is a risk of the third trouble enumerated above. The use of properly prepared starters is now practically universal, and in some factories in other countries one man's duty is solely the preparation of starters. If he does his work inefficiently the whole output of the factory may be adversely affected; every person knows that if a baker uses bad yeast his bread will be inferior, and in the same degree that good yeast is of importance to the baker, a good starter is of importance to the cheesemaker. In its preparation and subsequent treatment, therefore, the greatest care must be taken to prevent contamination.

Fig. 11.—Ladle for starter.

(After Decker.)

The beneficial effects of starter on dairy produce were first discovered between twenty-five and thirty years ago, when it was found that a certain organism produced a good flavour in butter and cheese. This germ was isolated and transferred to suitable media, such as sterilised separated milk. When the medium became sour this was in turn added to a larger quantity of milk, and thus it is carried on at the present day.

To Make a Starter.

To make starter, it is necessary to have two thoroughly clean enamelled buckets with lids. Next take some good separated milk, if obtainable, though as this is not often available in cheese dairies, it will usually be necessary to use whole milk. The cheesemaker himself should select a cow that is at least a fortnight past calving, and one that is in good health and not in season. As soon as the milk is drawn (with careful regard for the rules for cleanliness already discussed), it should be strained into the bucket, and the latter immediately set in some receptacle and its contents heated to 180 deg. Fah. for at least thirty minutes. At the end of this period the milk is either run over a cooler or poured backwards and forwards several times into another perfectly clean bucket. It is only necessary to have about a quart of milk at most for the preliminary process of making the starters. Cool this down to about 90 deg. Fah., then immediately add the pure culture, which is a substance containing the one organism only. Pure cultures can be obtained in powder form from dairy supply agents, but the Biologist of the Department of Agriculture supplies free and at any time cultures in liquid form, and these are thoroughly satisfactory. After adding culture to the pasteurised milk, place the lid on the bucket and wrap it up in a piece of thick, clean cloth, finally placing it in a room with a sweet atmosphere. In about twenty-four hours this milk will have thickened, and formed

what is called the " mother starter." Next take a freshly pasteurised lot of milk at 75 deg. Fah. in the other enamel bucket, using just sufficient to bring about the proper degree of acidity in milk in a reasonable time. With a pannikin or mug that has been thoroughly scalded skim the surface off the mother starter and throw it away, and from about the centre take a quantity of the thick milk and add to the fresh. Stir this throughout, either by slightly shaking the bucket or with a clean ladle.

This procedure is carried on from day to day until such time as the starter shows signs of weakening or going off in flavour. After each propagation the starter should be placed in a good situation; for a small dairy a good plan is to have a meat-safe large enough to hold a bucket, the safe being hung on the shady side of the building under the verandah, and a piece of cheesecloth being spread over it to keep out the dust. It is only necessary to wrap the bucket in a cloth when the mother starter is being made. A starter when ready for use should be of a smooth thickness, containing about ·6 per cent. of acid—when allowed to become too thick acid particles might cause discoloured spots in the ripened cheese. The flavour of the starter should be a clean acid, showing nothing foreign, and experience will soon teach the cheesemaker how to know when a starter is good or bad. When it is desired to taste a starter, never dip the finger in, but obtain a little with a clean mug from the bucket. Never, either, under any consideration, keep your starter in the cheese-ripening room, where it is liable to get contaminated with moulds; and, above all, do not allow flies to gain access to it, otherwise, in place of having a cheese starter, you will in all probability have a cheese finisher. When properly made and cared for, starters should last for several months.

Whey is sometimes used in place of milk to make starter, and if it is of good quality there is no danger in using it. The procedure is exactly the same as with milk—that is, it is thoroughly pasteurised before the culture is added to the first and to all subsequent propagations.

The percentage of starter that should be added varies considerably, according to district, climatic conditions, and, of course, the condition of the milk. Provided that the morning's and evening's milk shows an acidity of, say, ·18 to ·19 deg., about ·50 to ·75 per cent. of starter will be sufficient—that is, from 2 to 3 quarts per 100 gallons of milk, but no hard-and-fast rule can be laid down regarding amounts; and the cheesemaker must decide them for himself, bearing in mind the rule that the curd at the end of three hours after renneting should be well cooked, and should have a proper amount of acidity. Variation of this time indicates insufficient or too much starter.

When to add the starter is important. The cheesemaker on a farm generally has also to milk, and in such case he should examine the evening's milk, say, half an hour before the completion of the morning's milking, and if it is satisfactory add the starter, which should always be strained into the milk. When the two milks are mixed together it will be found that the acidity will be about right. Some good and experienced makers add about 1 drachm

of starter to every 100 gallons of milk (or about 1 drop to every 2 gallons) when the night's milk is properly cooled. This practice allows the desirable organisms to obtain control of the milk from the start, and checks the development of undesirable bacteria. When starter is put in the milk at night very little will be required in the morning. In a suitably cool climate this is an excellent method, and it is now practised extensively in the British Isles. The writer has seen it practised most successfully in some Victorian home dairies with good results, but he would advise caution in its adoption in New South Wales, and then its use only in dairies situated in the cooler parts and during the cooler months of the year.

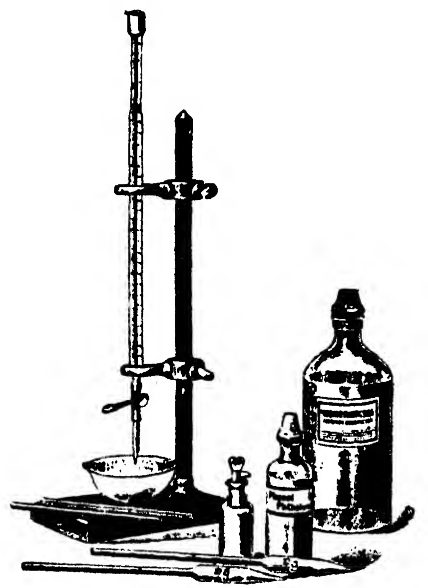


Fig. 12.—Acid-testing Outfit.

Showing burette in stand, porcelain dish underneath for making the test, glass stirring rod, 8·75 c.c.s. pipettes for measuring milk, drop bottle containing phenol phthalien solution, and stock bottle of n/10 caustic soda solution.

(After Tisdale and Woodnutt.)

The Rennet Test for Acidity.

The amount of acidity is determined generally by two methods —(1) the rennet test, and (2) Mann's acidimeter test. When the cheesemaker is dealing with the one milk from day to day, and able to control the care of the milk, the period of the process of manufacture need not vary more than ten minutes from one day to another, and thus uniformity is maintained. As the action of rennet will be greater or less in proportion to the percentage of acidity present provided the temperature is the same, we are able to determine by the time taken in coagulating a small quantity of milk if the right percentage of acid is present in the bulk milk. To perform the rennet test the cheesemaker will require a 4-oz. glass measure, a 1-drachm measure, thermometer, clock with a second-hand, cup, teaspoon, and a basin containing water at about 90 deg. Fah. First measure out 1 drachm of rennet, pour this into the cup, and into the rennet put a few small pieces of charcoal. Thoroughly stir the milk in the vat, then take 4 oz. (having the fluid at a temperature of 86 deg. Fah.), dip the outside of cup for a moment to take the chill off, and note the point where the second-hand is. Pour the milk rapidly into the cup, stirring with the spoon for five seconds. It will be noted that the charcoal revolves with the milk, but immediately coagulation occurs the charcoal will suddenly stop, when the number of seconds taken must at once be noted. If the time taken is, say, twenty seconds, the milk (with a proper strength

rennet) should be of the required stage of ripeness, and the time from renneting until whey drawing will be about three hours. Should this time be shorter and the curd be insufficiently cooked, then the cheesemaker should rennet next time when the test shows twenty-two seconds; and should, on the other hand, the process be unduly prolonged, he should rennet when the test is, say, eighteen seconds. Experienced cheesemakers will soon be able to know the right test to use. When a fresh bottle of rennet is likely to be opened for use in the course of a day or two, the rennet should be tested with that in use. Probably the fresh bottle will show some variation, say, an eighteen seconds test against the twenty seconds of the other in use, thus proving slightly stronger; if, on the contrary, it should give a twenty-two seconds test, then it is weaker. In performing the rennet test always see that all measurements of liquids and temperature are the same from day to day.

Mann's Acidimeter Test.

This test is of considerable assistance in ascertaining acidity. The outfit can be purchased for about 30s., and should always be present in the cheese dairy. It consists of the following:—one 25 c.c. burette, burette stand, two 8·75 c.c. pipettes, porcelain basin, glass rod, dropper bottle, a quart of decinormal solution of caustic soda, and a 4-oz. bottle of phenol-phthalein solution. The test is based on the knowledge that when an alkali is added to an acid (or *vice versa*) in a sufficient quantity a point will be reached at which the resulting mixture will be neither acid nor alkali, and is therefore neutral. The neutralisation point cannot be ascertained except by chemical means, and in this test the indicator used is phenol-phthalein; when added to an alkaline substance it produces a deep red colour, and in an acid solution it produces no change.

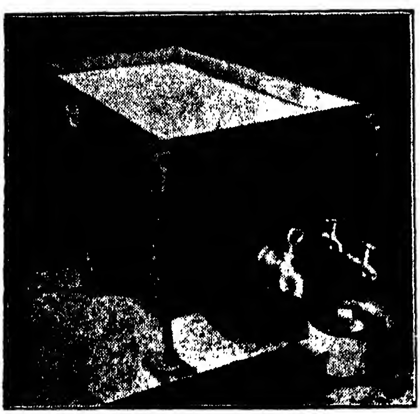


Fig. 13.—Milk in vat ready for renneting.
The fluming on the floor in the foreground is the whey conductor.
(After Tisdale and Woodnutt.)

The procedure to follow in testing acidity in cheesemaking by this means is as follows:—Thoroughly stir the milk in the vat, by means of the pipette measure exactly 8·75 c.c. into the porcelain basin, and add two drops of the indicator. Fill the burette up to the zero mark with the soda solution, and gradually drop the soda into the milk, stirring with the glass rod continually until a permanent faint-pink colouration is produced. This shows that the substance is neutral. Now read off the quantity of alkali taken. Each space on the burette represents ·1 of a cubic centimetre, so that, should it take nineteen spaces, the quantity is 1·9 c.c., indicating that when the alkali

is of proper strength ·19 per cent. of lactic acid is present in the milk. Avoid as far as possible exposing the soda to atmospheric influences, which deteriorate it. In addition to corking the bottle tightly, a small cork should be placed in the burette and tightened after each time of using; needless to say, it must be slackened for each test, otherwise a vacuum would be created, preventing the liquid flowing through the tap. In large factories a special outfit is used, which allows the soda to syphon direct from the bottle into the burette, air being admitted into the bottle through a bulb filled with soda lime, which collects moisture and other impurities. Owing to the smallness of the extra expense of this apparatus as compared with the smaller outfit it might be well worth installation, even by the small factory.

When washing the utensils in connection with this test always rinse out in clean rainwater—water containing washing soda, which is also an alkali, would be liable to cause wrong readings. Some of our cheesemakers make up their own alkali solutions, but this is not advisable, as there is danger of not having the liquid the proper strength. A better way, if economy is a vital point, is to obtain from a wholesale chemist a half Winchester quart of normal caustic soda solution; if nine times this quantity of pure water is added, the one-tenth normal solution is obtained. The diluted soda should then be put into thoroughly clean bottles, which, after thorough washing in the ordinary way, should be rinsed out with some of the solution. The bottles should be well stoppered and sealed with wax.

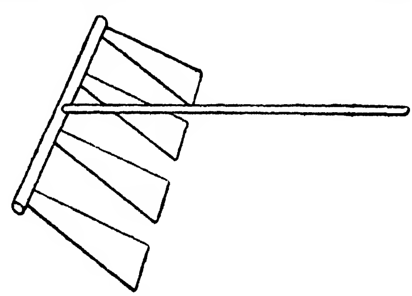


Fig. 14.—Rake for stirring curd and milk in the vat.

(After Decker.)

Colouring the Cheese.

The desired degree of acidity having been obtained, the milk (which by this time should be at a temperature of 86 deg. Fah.) is fit for renneting. As the cheese manufactured in this country is generally artificially coloured, it is necessary to add the colouring matter, which is an extract of annatto, at least five minutes before renneting. The amount of colour required varies according to the quality of the milk, the period of lactation, and some other factors. Less colour will be needed for milk from cows in the early period of lactation than for that from those in the latter stage, and less will be needed for milk from animals fed on green pasture than for those fed on pasture that is parched and dry; again, milk from Jersey or Guernsey cows needs less colour than certain other milks. As so little colour is used, however, these points are not very material. When cheese is manufactured for sale in the Australian markets the amount used is generally from ½ to 1 oz. per 100 gallons of milk. When made for export to the British market 1½ to 2 oz. per 100 gallons is necessary—that is, of course, when coloured cheese

is required. The colour should be mixed with several times its volume of clean water and thoroughly stirred throughout the milk. If the same glass is used for measuring colour and rennet, always wash it thoroughly after it has contained the colour, which contains a strong alkali, and will destroy to a great extent rennet action.

The Process of Renneting.

Coagulation of milk, as we have already seen, can be brought about by means of dilute acids, rennet, and pepsin. The curd procured by acid coagulation is unsuitable for cheesemaking, and therefore either rennet or pepsin is used. The writer prefers to use rennet, which is an extract specially prepared from the calf's stomach. Some cheesemakers obtain the vells and make their own supply of rennet, but in a hot climate it is questionable whether this is preferable to purchasing the necessary supply. The writer has certainly seen some home-made rennet that must have been prejudicial to the cheese, owing to the large number of foreign organisms it contained, and although the price is rather high at the present time, it is advisable to pay the price rather than use a bad material. There are a number of excellent brands on the market, any of which can be recommended. Generally it takes about 4 oz. of rennet per 100 gallons of milk to bring about firm coagulation with the proper degree of acidity and temperature in thirty-five minutes. A smaller quantity of some rennets will be sufficient, while of others more will be required, and from a comparison of the necessary periods, some idea of the values of the different brands may be arrived at. Like colour, rennet should be well diluted with pure cold water before being added to the milk, a more perfect distribution being thus ensured. The rennet should be fairly equally spread over the surface of the milk, which should be vigorously agitated with a rake. The stirring should be continued for about five minutes with a normal milk, and the speed of stirring should be gradually reduced towards the end of this period, when the rake is removed. As the outlet of the vat will contain a certain amount of milk which will not be acted upon by the rennet otherwise, this portion should be put back in the vat when the stirring is finished. After this the surface of the milk should be gently agitated for another five minutes or thereabouts to keep down the fat. This agitation must not be continued once the rennet shows signs of acting, which is shown by the milk becoming thick. Cover the vat over either with a canvas or wooden cover to maintain an equal heat throughout the coagulation.

(*To be continued.*)

Despite the rather frequent expression of views to the contrary, saltpetre is of no value in assisting the burning of stumps. The best way to deal with a stump that burns badly is to build a good pile of logs and brush around it, fire in the ordinary way, and cover the burning material, when well alight, with clay. Such a fire will smoulder for some weeks, and will gradually destroy the stump.—A. H. E. McDonald, Chief Inspector of Agriculture.

Sheep-maggot Flies and their Parasites.

Observations made during the Investigations carried out at the Government Sheep-fly Experiment Station, Warrah, 1920–21.

[Concluded from page 731.]

W. W. FROGGATT, F.L.S., Government Entomologist.

The Digger Chalcid Parasite (*Dirrhinus sarcophagæ* Froggatt).

This curious chalcid wasp was described and figured in the *Agricultural Gazette* in December, 1919, from specimens obtained at Moree which emerged from the pupæ of the flesh-fly (*Sarcophaga aurifrons*) in our breeding cages. It has since been obtained at the Glenfield insectarium, parasitic upon the larvæ of the large yellow blow-fly (*Calliphora villosa*). It is the first species recorded as a parasite upon blow-flies. Other species have been recorded as parasites on the pupæ of fruit-flies in Africa and India.

(*Spalangia grotiusi* Girault).

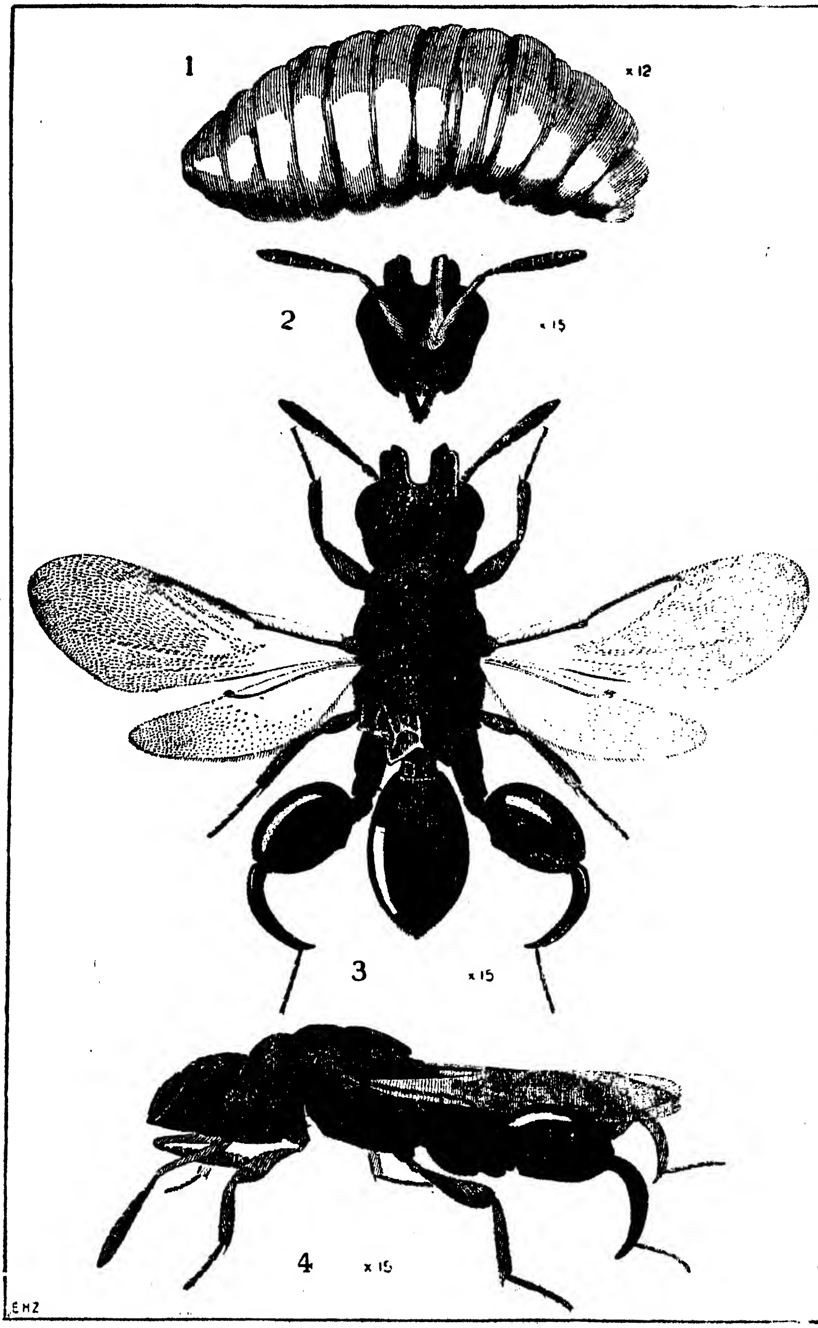
The type specimen was described from a single female captured by sweeping in partly-cleared forest country at Nelson, near Cairns, North Queensland.

Taylor bred some twenty specimens from the pupæ of blow-flies when entomologist to the Queensland Sheep-maggot Fly Committee, but very little has been recorded about its life history or habits. Girault described three other species at the same time, but as this one was described from a male specimen, and the others each from a single female or male specimen without any illustrations, they are not very satisfactory.

(*Spalangia muscidarum* Richardson).

In 1913 C. H. Richardson published a paper in *Psyche*, entitled "An Undescribed Hymenopterus Parasite of the House-fly." Originally described from the United States of America, this parasite has been found to be common in Queensland. Harvey and Bancroft in their paper (*Proceedings Royal Society of Queensland*, 1920) give a detailed account of this parasite, which they state has been bred from all the different species of sheep-maggot fly pupæ in Queensland, as well as from the house and stable fly.

According to these investigators, this parasite usually deposits only one egg in each fly pupa parasitised. Therefore, unless it can be shown that the members of the genus *Spalangia* deposit individually more eggs than a female *Nasonia* they will not pay to breed artificially in competition with this established chalcid wasp. We bred one specimen of this, or a closely allied species of the genus, from a sheep-maggot fly pupa at the experiment station at Hay.



The Digger Chalcid Wasp (*Dirrhinus sarcophagæ*).

1. Larva or maggot from the pupa of the flesh-fly (*Sarcophaga aurifrons*). 2. Head of digger chalcid wasp, showing frontal cleft in head and antennæ. 3 Dorsal view of chalcid wasp. 4. Side view of chalcid wasp.

The House-fly Parasite (*Alysia manducator* Panzer).

This is a well-known hymenopteron, belonging to the family *Braconidæ.* It was described by Panzer in 1799 under the name of *Ichneumon manducator,* and later on by Fabricius as *Cryptus manducator.* It is common in England and over the greater part of Europe. It is, comparatively speaking, a large braconid parasite, and is closely related to the members of the genus *Bassius,* which latter confine their attention to the larvæ of the hover flies (family *Syrphidæ*). This family continues one of the most useful groups of friendly insects that wage ceaseless war on all the different plant lice (*Aphidæ*) that destroy our cultivated trees.

Alysia manducator, like her allies, is an indiscriminate parasite on the pupæ on all kinds of flies, and among others is very partial to those of the European syrphid flies. It is, therefore, a hyper-parasite—a danger that all economic entomologists have to guard against when introducing foreign parasites into a new country.

In an abstract of a paper in the last *Proceedings of the Zoological Society* of London, by Messrs. Lefroy and Alston, published in the *Times,* 11th October, 1920, entitled "Enemies of the Blow-fly: Parasites to Check a Sheep Pest," the writers state that this fly parasite was accidentally discovered with others in the Zoological Society's Gardens when investigating the maggot-infested manure. There is nothing very remarkable in such a discovery, for *Alysia manducator* has been recorded by many previous investigators as a parasite on all kinds of muscoid and other flies. They further state that "*Alysia* is a more effective enemy of the blow-flies than *Nasonia.*" Now our experience from careful field investigation shows that any parasite that only lays one egg in its host can never be so effective as one that deposits up to thirty-five or more, as *Nasonia brevicornis* does. Any parasite like *Alysia manducator* that deposits her egg in the larva or maggot of the fly is also less effective in regard to sheep-maggot flies than those which parasitise the flies in the pupal or chrysolid stage of their existence. The maggots breeding in undisturbed carcases or carrion and in live wool are working under cover, and a very small percentage will be exposed and be at the mercy of a maggot parasite. On the other hand, the full-fed maggots falling from the live wool on the ground usually pupate above the soil, and those in a dead beast crawl to the edge of the disintegrated carcase to pupate, and thus are nearly all accessible to the ovipositor of the pupa parasitiser. The writer would strongly protest against any proposal to introduce a wasp into Australia which would be a certain enemy of the valuable syrphid flies that often completely clean our roses and peach trees of aphis.

It was the discovery of this particular parasite (*Alysia manducator*) that created such a pleasurable excitement in the minds of the Australian sheep-owners when a cable, followed by an article by an Australian pressman (Mr. Arthur Mason) appeared in the *Sydney Morning Herald,* 23rd September, 1919. In this article Professor Lefroy claimed that he had the control of the blow-fly in Australia in his hands. "It is now possible to guarantee

that under proper conditions of control a selected blow-fly area in Australia can be cleared of blow-fly within eighteen months, a large area in three years, and probably the whole infected area in five years." In conclusion, Mr. Mason wrote, "to use his own words to me, there is no reason why Australian pastoralists, farmers and settlers should not benefit. They can eradicate blow-fly absolutely, certainly at small cost and with no labour of their own, and the continent of Australia can be permanently cleared of blow-fly within five years."

Methods of Dealing with Blow-flies Infesting Sheep in other Countries.

We have very little information from the British veterinary journals regarding the amount of damage caused by muscoid flies in England and Scotland. In other parts of the world, particularly under war conditions in the East, a considerable amount of attention was given to the fly pests which swarmed and bred in the accumulated refuse of the military camps, reports upon which are now being published.

Major W. S. Patton publishes in the Indian *Journal of Medical Research* some interesting records of his work, "Part II, Mesopotamian House-flies and their Allies" (vol. vii, pp. 751–777, 1920). Among these several blow-flies are recorded. The chief methods of control adopted were the burning of refuse in closed incinerators, and the attracting of flies to matter in which they deposited their eggs and subsequent burning of the infested refuse. The author also recommends traps for the adult flies, and the use of torches for burning the resting flies at night.

Other Information Published.

In the official journal of the Institute of Science and Industry (July, 1920, Vol. ii, No. 7) there appeared an article entitled "The Blow-fly Pest: Scheme of Biological Experimentation," in which it was claimed that one of the first acts of the Institute was to investigate the sheep-maggot flies. As a matter of fact, investigation of the problem had been undertaken by the Entomological Branch of this Department as far back as 1904, and the writer's first paper, "The Sheep-maggot Fly, with Notes on other Common Flies," was published as Miscellaneous Publication, No. 809, January, 1905.

Early in 1913 the New South Wales Department of Agriculture and the Pastoralists' Sheep-maggot Fly Committee combined forces, collected funds, and empowered the writer to organise and equip a field experiment station for the investigation of sheep-maggot flies. The first report of the field and laboratory work of this experiment station was published in Farmers' Bulletin, No. 95, "Sheep-maggot Flies," in 1915. A second bulletin was issued in 1916, and a third bulletin in June, 1917, reporting the work of the experiment station. The Pastoralists' Committee then received a grant of £448 from the Federal Council, which was expended, with its own funds, at the Moree experiment station and at the present demonstration experiment station at Warrah.

To all this work, and to the reports thereon, the report published in *Science and Industry,* in 1920 already referred to, makes no reference.

In the *Proceedings of the Zoological Society* of London, September, 1920, Mr. A. M. Alston furnishes a paper (pp. 195-243 and twenty figures): "The Life History and Habits of Two Parasites of Blow-flies." This is based upon observations made in connection with work at the insect house upon the braconid and chalcid wasps previously noticed in the writer's notes on the parasites of sheep-maggot flies.

In the *New Zealand Journal of Agriculture,* January, 1920, Mr. D. Miller contributes a paper entitled: "Some Noteworthy Flies affecting Live-stock." In this paper the author states that they have no record of an indigenous fly attacking domestic animals. He enumerates the two European species, *Lucilia sericata* and *Calliphora erythrocephala,* and the New Zealand blow-fly *C. quadrimaculata* as common in New Zealand, and *Pollenia* (*Calliphora*) *villosa,* the commonest of our large yellowish house blow-flies, as being also the common house blow-fly in that country.

The Synonomy and Range of Various Sheep-maggot Flies.

In the earlier reports on the sheep-maggot flies the various species were grouped in the genus *Calliphora.* Later research by specialists on the Diptera have brought about a finer sub-division of the species, and only a few typical blow-flies remain in this genus. In the last report the hairy maggot-flies were placed in the genus *Pycnosoma;* they have now been placed in the oriental genus *Chrysomia,* and our larger species have been identified as the common Indian form.

Chrysomia albiceps, Wiedman. (*Calliphora* (*Pycnosoma*) *rufifaces* in previous reports).

In correspondence and exchange of specimens with Major W. S. Patton, of the Pasteur Institute, Coonoor, South India, I have received certain information and identifications. Major Patton writes: "After again comparing your species with this Indian form, I have come to the conclusion that they are identical. I have now no doubt on this point, particularly when I note that your description of the larva of this species exactly corresponds with the larva of *Chrysomia albiceps.* This is a point of utmost importance in India, as this fly is widely distributed and is a most dominant species. I think I told you that its larva is predaceous and feeds on other larvæ living with it. In Mesopotamia I took it from heaps of horse manure and other refuse feeding on horse-fly larvæ of *Chrysomia flaviceps.*"

This metallic green and blue sheep-fly is the common blow-fly all the year round in the Warrah district, and is particularly prevalent in the spring and summer months of the year. All classes of country suit it—open, grassy plains and flats, or forest country. We might, however, consider it more a forest hunter, being more numerous in the paddocks where sheep were running. In traps in such situations in the summer months, probably 75 per cent. of the catch were of this species.

Chrysomia flaviceps, Walker, (*Calliphora* (*Pycnosoma*) *dux*, Esch).

This is the common species in the New Hebrides and the Solomon Islands; I think also in North Queensland. It is the one listed in Miscellaneous Publication, No. 1764 (September, 1914), Department of Agriculture, New South Wales, in mistake as the island sheep-fly (*Lucilia tasmaniensis*), and as doing considerable damage to sheep in the New Hebrides.

Major Patton says, "This is the common oriental and Ethiopian bazaar and tody-shop fly. It very occasionally causes cutaneous myiasis in animals. I have records of two cases. It readily breeds in decaying animals and similar refuse."

Neopollenia styga, Fab. (*Pollenia* (*Calliphora*) *villosa*).

In Townsend's catalogue this species is placed in the genus *Neocalliphora* of Brauer as Fabricius' species, which takes the place of Desvoidy's specific name, *C. villosa*. At Warrah these large yellow blow-flies appeared in considerable numbers towards the end of April, and were more or less in evidence until the warm weather set in. They were readily attracted to the traps in all kinds of country, but are always more numerous on the hills or in the valleys on the hillsides. High up the slopes of the Australian Alps they swarm like bees in the summer months; and during the end of summer they swarmed into the tents and laboratory at Warrah until trapped. This species, which is the typical domestic or house blow-fly all over Australia, cannot stand the heat of summer, and usually congregate in all sheltered places on hot days. This habit is shared by the common North American blow-fly (*Pollenia rudis*) which is popularly known as the cluster fly from its swarming into rooms, where they cluster together in the corners.

Paracalliphora oceaniæ, Desv. (*Anastellorhina* (*Calliphora*) *auger*).

In his catalogue Townsend uses the above genus, created by him in 1916, and defined in vol. xlviii of the *Canadian Entomologist*, p. 151, 1916, and at the same time retains Desvoidy's name in preference to that of Linne, though, as previously pointed out, the latter brief description fits this blow-fly.

This smaller yellow blow-fly (easily recognised from the previous species by its blue abdomen blotched with pale yellow on either side and the white down on the tip) is also common all the year round in the Warrah district. Like the previous one, it diminishes in numbers as the hot weather comes in, but clings to sheltered places all through the year.

Lucilia sericata, Meig.

This is the commonest and most persistent fly all through the year at Warrah, both in the paddock traps and about our camp. At times probably 75 per cent. of the flies caught in the traps near the homestead and camp were of this species. Any vegetable or animal refuse about the kitchen galley, any apple peelings or core thrown out would be immediately covered with these bright metallic green flies. These are the chief flies found in the gardens, backyards, and streets of Sydney, feeding on all kinds of refuse.

When in carrion, the pupæ may be just under the soil or on the surface beneath the remains. The nearer we come to the coast, and the farther from the western lands, the more numerous is this brilliant metallic green and coppery-tinted fly. At Warrah it has been the common green-fly all the year, and sheep were blown by it in March and April, 1920.

Eumusca australis, Macq.

In our previous reports this has been described under the name of the small black bush-fly (*Musca corvina*).

In Townsend's catalogue this species is identified as Macquart's *Musca australis*, and is placed in his genus Eumusca, defined in the *Proceedings of the Entomological Society*, Washington, 1911. Like the large house-fly, it breeds in tainted or decaying vegetable matter, and swarms into the bush far out into the dry interior. This is the fly pest of the bush, swarming over the face and hands from daylight to dark. Large numbers were always congregated about our traps all through the summer.

Bokhara Clover v. Lucerne, at Medlow.

Mr. Arthur Griffith has forwarded specimens of lucerne and Bokhara clover plants to show their comparative growths when sown on ordinary orchard land at Medlow (Blue Mountains), without being irrigated or specially manured. The Bokhara clover is very much superior in all respects. The details may be presented thus :—

	Lucerne.	Bokhara Clover.
Root System	10 inches long. Main root $\frac{1}{16}$ inch in diameter. Lateral roots, 5 to 7 in number.	21 inches long. Main roots $\frac{1}{4}$ inch in diameter. Lateral roots, 30 to 35 in number.
Stem and Leaf ...	5 inches high. Leaves few, small and affected with rust.	13 inches high. Leaves numerous, large, and free from disease.

E. Breakwell, Agrostologist

The Control of Slugs.

As slugs readily take advantage of all kinds of refuse for shelter in the daytime, it would seem advisable to plough in crop residues immediately after the removal of the crop, and organic manures as soon as applied . . . . This is specially important during the period when no crops are available on arable land. All vegetation on waste ground, hedge, ditch, and pond-sides should be periodically turned. Cleanliness and tidiness in stockyards, around root clamps, and in gardens should always be maintained, since all material lying about harbours slugs to a remarkable extent.—H. W. Miles, *Journal of the Ministry of Agriculture*, London.

Getting Colonies Ready for the Honey Flow.

The development of a colony of bees in spring depends upon three factors—(1) the queen, (2) the supply of nectar and pollen, and (3) the combs contained in the brood chamber. A colony in which the queen is exhausted from two seasons of laying, and in which the bees have failed to supersede, will invariably dwindle, despite the most favourable conditions for brood-raising. Such colonies should be marked for re-queening at the earliest opportunity, or united with some other colony that has come through the winter in a weak condition, but that is yet headed by a young vigorous queen.

No matter how vigorous a queen may be, if supplies of honey and pollen are not available in the hive or are not forthcoming from natural or artificial sources, the colony will not develop satisfactorily. In such a case equalising of stores may be resorted to, and where this is impracticable, the colony should be fed. The latter should not be necessary this season, as the bountiful rains that have fallen afford assurances of good supplies of food from natural sources in most districts.

Upon inspection, a colony may be found queenless, in which case a frame of brood containing eggs in worker cells should be taken from a healthy Italian hive and placed in the centre of the cluster; by feeding the worker larvæ upon a special food known as royal jelly, the bees will produce a queen.

The importance of good combs within the brood chamber is by no means secondary, and no queen, however prolific, can prove her worth unless the brood chamber is equipped with profitable combs. *i.e.*, combs containing a maximum number of worker cells. This factor is largely responsible for the numerical strength of certain colonies, and, of course, is directly responsible for the amount of surplus honey gathered. With excessive drone comb in the brood chamber the energy of the queen and workers is spent upon raising large numbers of drones, while, if the same amount of attention had been devoted to raising worker bees, failure would have been converted into success.

When overhauling hives in the spring, the opportunity should be taken to eliminate combs that are too old or that contain too many drone cells (large cells). Such combs at this time are usually free from brood, but if they contain honey or pollen that the colony can ill afford to lose, they may be worked to the side of the hive to prevent the queen from laying in them, or if removed altogether other combs of stores should be given in their place.

The spreading of brood in spring is undesirable. A good queen will not lay eggs outside the area which her bees can cover, and to insert a cold, empty comb in the centre of the cluster, instead of assisting will have detrimental effects upon the colony. Weak colonies may be helped by giving a frame of sealed brood actually emerging from their cells; but if disease is suspected in the apiary the less changing of combs the better.

The apiarist should be acquainted with the various sources of surplus honey in his district, and should aim at having his colonies in vigorous condition when the flow opens.—H. Graham Smith, Instructor in Apiculture, Hawkesbury Agricultural College.

Tuberculosis in Pigs.

W. L. HINDMARSH. B.V.Sc., M.R.C.V.S., D.V.H.

TUBERCULOSIS is an infective disease to which both men and animals are subject, cattle and pigs being the stock most susceptible to infection. The significance of the disease in the pig has yet to be fully appreciated by farmers engaged in the industry, and the object of this article is to impress upon pig-farmers the necessity for strict supervision of their methods of management.

Whatever the animal, tuberculosis is caused by a germ (technically known as the tubercle bacillus), and infection takes place in the pig almost always through the animal eating food which contains the germ. Of all sources of infection the one of greatest importance is the tuberculous dairy cow. In the milk, dung, and discharges from such an animal tubercle bacilli are liable to be found at any time. The feeding of pigs on skim milk, whey, &c., is rightly regarded as the most economical method of disposing of these by-products of the dairy; but if these goods contain the bacilli of tuberculosis it is evident that in eating them the pig may itself become infected. If, as is usually the case, the milk is mixed in a common vat before separating, a whole herd of pigs may become infected through but one or two cows excreting the germs with their milk. If the separating be done at a factory and the dairyman takes back the skim milk to his farm, he may easily spread tuberculosis through his pigs from milk received from other dairies where the disease is present. In this way numerous pig farms may become infected from comparatively few tuberculous cattle.

The dung and discharges from tubercular cattle are both sources of infection. It is not uncommon for pigs to be given free run over pastures and yards used by cattle, and where the cattle are healthy there is no harm in this practice; in existing circumstances, however, cattle are examined only for manifest signs of tuberculosis, and as a potential aid to infection there is much to condemn it. It must be borne in mind that cattle may be affected with tuberculosis and show no sign whatever of the disease, and at the same time may be voiding tubercle bacilli in the dung, saliva, and nasal discharges, and pigs roaming about the yards and paddocks, and rooting among the dung and herbage may easily ingest the germs of the disease.

Another method by which pigs may become infected is by eating the flesh and organs of a tuberculous beast. At country slaughter-houses pigs are usually kept to dispose of the offal. This offal should be boiled before being fed, but cases arise where pigs gain access to it and eat it uncooked. Similarly, pigs on a farm will attack a carcase left lying in the paddocks. There is a very grave danger in such cases of the germs of tuberculosis

gaining entrance to the system, and thus causing the spread of the disease through the pigs.

Other means of infection, which are not so important but may occur, and hence should be guarded against, are:—(*a*) Spread of the disease from a tuberculous pig to others in the same herd. (*b*) Spread of the disease from a tuberculous sow to the litter being suckled; as with the cow, this may take place through the milk as well as through body discharges. (*c*) Cases where infection has gained entrance to the body through wounds such as castration wounds.

It will be noted that the greatest emphasis is placed on infection through the mouth. It is understood that animals may take the germ in through the breathing organs or through wounds, but in the pig the evidence points to ingestion of the bacilli as the most common portal of infection.

Symptoms.

Usually on examination it is the glands about the head and throat that show the first signs of the disease. This is due to the irregular surfaces of the large tonsils allowing lodgment for the germs. Moreover, pigs will eat all variety of materials and will pick up, various hard and sharp objects with their food. These may lacerate the mouth and throat and through the injuries so caused the path of infection is made more easy for the tubercle bacillus.

Young pigs appear to be more susceptible than mature animals, but definite signs of the presence of the condition is rarely seen before death. Pigs in prime condition often show extensive areas of tuberculosis when slaughtered, no suspicion of disease having been held by the owners beforehand. Sometimes poor condition, lack of appetite, and a general unthriftiness may be observed. In advanced cases diarrhœa alternating with constipation (in intestinal infection), or cough with rapid respiration (in lung infection), may at times be noted; but as these symptoms may also be caused by entirely different diseases no reliance can be placed on them as a definite means of diagnosis. When the glands of the throat are diseased they may sometimes be felt as hard lumpy swellings, but the fact that such swellings cannot be detected is no proof that the pig is not tuberculous.

Post Mortem Examination.

The most common seat of infection of pigs is to be found in the lymphatic glands in the region of the head and throat; it has been estimated that over 90 per cent. of tuberculous pigs have these glands infected. The glands may be found between the branches of the lower jaw and immediately above the throat. They become enlarged, with fibrous walls, and show areas containing a cheesy or gritty material. These areas may be scattered and as small as wheat grains, or they may take up the greater part of the gland substance. Other parts commonly invaded and showing similar diseased areas are the lymphatic glands situated between the lungs, the glands attached to the stomach, liver, and intestines, the liver, lungs, spleen, and occasionally bones, and the mammary glands.

Preventive Measures.

There is no practical method of treatment of tuberculosis in animals, but by attention to the following precautions the disease may be kept under control:—

1.—As cattle are the main source of infection, the tuberculin test should be applied to the herd and all reactors removed.

2.—Do not allow pigs to roam about pastures and yards used by cattle unless it is definitely known that there is no tuberculosis in the herd.

3.—All skim milk and other dairy products should be heated to 180 degrees Fahr. and kept at that temperature for fifteen minutes before being fed to pigs.

4.—All refuse, slaughter-house offal, and similar foods should be boiled before it is given to pigs.

5.—Where tuberculosis is found to be present in the herd, all suspected animals should be slaughtered, and where this is done under qualified supervision the carcases which have only a slight infection of the head glands will be passed for human consumption, the affected parts only being condemned. The pens should be thoroughly disinfected and lime-washed, disinfectant being added to the lime. All litter and rubbish in the yards should be burned and the ground loosened and treated with quicklime.

Fresh air and sunlight are great enemies of the tubercle bacillus. Hence pens and sties should be open and airy, and have no damp dark corners to which the air and sun cannot penetrate.

Vineyard Notes for November.

The season's plantings will now be finished. We have been fortunate in experiencing weather conditions which have favoured a good strike, and already many of the earlier plantings are showing quite excellent growth.

The moist spring, being associated with sunny days, has also induced much growth of weeds, &c., and in a season such as the present cutworms are likely to make their appearance. Consequently, growers should be on the look-out for the first indications of any trouble, especially in the young plantations. If cutworms make their appearance it is wise immediately to spray with arsenate of lead. The arsenate of lead may be conveniently mixed with Bordeaux mixture, and the two applied as a combination spray against both cutworms and downy mildew. Where the cutworms are showing up very badly, baits will have to be laid also.

Cultivation should be well attended to from now onwards, the soil being kept in good tilth, and free from weeds. After every good rain the soil requires stirring, the surface being at no time allowed to cake and set, as that means increased capillary action, and consequently greater loss by evaporation of soil moisture. One of the main factors of success in vine-growing is the conservation of soil moisture during the spring and summer months.—H. L. Manuel, Viticultural Expert.

COMBATING CODLIN MOTH.

IN dealing with the codlin moth, it is a good practice to examine the trees thoroughly before the larvæ (the grubs) start to change into moths, and again in the spring, taking off any loose bark and destroying any codlin grubs harbouring under it, as well as any in holes, cracks, or rolls in the bark. A piece of wire will assist in this work. Though most of the grubs will probably be found in the trunk and crown (where the main limbs spring from), it is best to follow right up along the main scaffolding branches of the tree. Killing these carry-over grubs from previous years will reduce the first brood for the coming season.

In the Department's Spray Leaflet No. 6, full information is given as to spraying with arsenate of lead, but if the moth has been very bad, I would advise a double calyx application as follows:—The calyxes of the earlier blossoms will start to close before the petals of the later blossoms have completely dropped, so that it is necessary to apply the first or calyx spray while there are some petals still on the tree; otherwise some of the calyxes will close before any of the spray is lodged within them. When the petals of the later blossoms have fallen, give a second application before the larger calyxes have closed. It might be mentioned that the later application mentioned in the leaflet is to protect the apple as it grows, and exposes fresh surfaces not protected by the previous applications.

Unfortunately, the spray dries in beads, not in a uniform coating all round the fruit. For this reason soap is used as a spreader for the later application at the rate of 1 lb. to 12 gallons of spray mixture. Care must be exercised in mixing the soap with the arsenate. If, for instance, 24 gallons of spray are to be mixed, first mix the required quantity of lead arsenate with, say, 22 gallons of water, then dissolve the soap in 2 gallons of water, and vigorously stir the soap solution into the lead arsenate solution, and use at once. If the mixture stands for any length of time before use, enough lead arsenate may be rendered soluble to cause damage to both fruit and foliage. Lead arsenate spray is not a solution, but is only a mixture, and must, therefore, be kept well stirred while being applied, whether used in conjunction with soap or by itself.

A careful watch should be kept on the trees early in the season, and when the first grubs are noticed starting into the young fruit (they only make a tiny mark at first) the fruit on the trees should be thoroughly examined and any attacked fruit picked off and boiled or burnt. If this first brood is checked in this way, the later broods will be marvellously reduced. A bandage (cut from a piece of bag) should be put around the trunk of a tree and carefully examined once a week, and any codlin grubs being harboured, destroyed. These grubs are those that have eaten into the fruit and done their damage, but if they are not destroyed they become moths, and a female moth can lay sixty eggs, which soon hatch.

If your neighbours have apple, pear or quince trees within a mile or so of your own, you should induce them to adopt the same treatment, and do not neglect any odd trees of your own, as neglected trees in the vicinity will breed moths to infect the whole neighbourhood.—W. J. ALLEN.

The Chemical Composition of Mangels.

A. A. RAMSAY, Principal Assistant Chemist.

THE mangel is fairly extensively cultivated in Great Britain to provide food for pigs and cows, but it has not so far attracted much attention in New South Wales. Its high percentage of nitrogenous constituents or albuminoids, in proportion to the dry matter present, and its succulence and palatability, suggest that it would form a useful addition to the crops already grown for feeding purposes in this country.

The following particulars are compiled from the analyses of the roots of certain varieties of mangels grown for experimental purposes at Grafton Experiment Farm, Glen Innes Experiment Farm, and Hawkesbury Agricultural College, Richmond. Little information as to the variation in the composition of mangels can be found in modern standard works of agricultural chemistry, and it is considered that the present investigations should prove a useful contribution to our knowledge on this subject.

An average of the total analyses made in connection with the recent trials in this State shows the mean composition of the mangel to be :—Moisture, 92·01 per cent.; albuminoids, ·99 per cent.; ether extract, ·04 per cent.; fibre ·77 per cent.; ash, 1·37 per cent.; and nitrogen-free extract, 4·80 per cent. For purposes of comparison, the following table gives the composition as given by various authorities :—

Authority.	Moisture.	Albuminoid.	Ether Extract.	Fibre.	Ash.	Nitrogen-free Extract.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
*American ...	90·9	1·4	·2	·9	1·1	5·5
†English... ...	88·0	1·1	·1	·9	1·1	9·1
‡English... ...	87·5	1·1	·1	·8	1·1	9·4

* Jordan, "Feeding of Animals"; Henry, "Feeds and Feeding"; Voorhees, "Forage Crops."
† McConnell's Agricultural Note Book.
‡ Calculated from figures given by Wood and Berry in *Journal of Agricultural Science*, Vol. I.

How widely the composition of the mangel may vary is indicated by the following table, which shows the ranges in variation of all the varieties grown at the three different institutions in this State, and those of English mangels as given by Wood and Berry.

	New South Wales.			English.		
	Highest.	Lowest.	Range.	Highest.	Lowest.	Range.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Dry matter	18·97	3·87	15·10	16·7	8·5	8·2
Water	96·13	81·03	15·10	91·5	83·3	8·2
Albuminoids	2·12	0·56	1·56	1·57	0·52	1·05
Ether extract	·08	0·01	0·07	...	...	...
Fibre	1·30	0·41	0·89	·88	·68	·20
Ash	1·96	1·11	0·85	...	...	...
Nitrogen-free extract ...	14·97	1·24	13·73	13·7	5·5	8·2

It will be noted that the ranges of variation in the percentage composition are much greater in mangels grown in New South Wales than in those grown in England.

Not only does the percentage composition of the mangel as grown vary, but the percentage composition of the dry matter content varies to a much wider extent. The following table shows the extent of this variation in all varieties grown at the three farms.

	Highest.	Lowest.	Range.
	per cent.	per cent	per cent.
Albuminoids	22·26	7·41	14·85
Ether extract	0·98	0·16	0·83
Fibre	18·86	2·28	16·58
Ash	36·38	6·74	29·64
Nitrogen-free extract ...	83·40	32·04	51·36

An interesting aspect of the investigations has been a consideration, on the one hand, of the variation between the average composition of eight selected varieties of mangels grown under the widely differing conditions of the three farms, and, on the other hand, of the variation between all varieties when grown alongside one another at any one of the farms. It would appear that the conditions under which the crop is grown are of greater consequence in relation to the composition of the crop than the variety.

TABLE showing the variation in composition of certain varieties when grown under different conditions, and compared with the variation in the same varieties when grown under the same conditions.

	Variety.									Farm.			
	Sugar.	Yellow Globe.	Golden Tankard.	Mammoth Long Red.	Golden Globe.	White Sugar Rose Top.	Giant Half Green Top.	Prizewinner.	Average.	Grafton.	Glen Innes.	Hawkesbury Agricultural College.	Average.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Moisture	12·04	7·74	9·08	9·17	11·64	11·69	10·68	7·11	9·89	2·57	7·35	3·56	4·49
Albuminoids	·51	1·13	·75	·92	·92	1·27	1·47	1·02	1·00	·45	·81	·39	·55
Ether extract... ...	·01	·02	·06	·04	·01	·01	·01	·01	·02	·06	·02	·08	·04
Fibre	·68	·65	·43	·45	·16	·53	·57	·53	·50	·34	·89	·52	·58
Ash	·28	·48	·52	·81	·29	·54	·81	·33	·51	·27	·75	·44	·49
Nitrogen-free extract...	12·50	5·46	7·43	7·24	10·73	9·37	9·54	5·23	8·40	2·54	8·10	3·62	4·75
Nutritive value ...	13·0	6·7	8·2	8·2	11·6	10·6	10·7	6·2	9·40	2·5	7·3	3·7	4·5

Continuing this line of investigation to the comparative variation in the percentage of dry matter content of the eight varieties when grown under various conditions, and that of the same eight varieties when grown at any one farm, it will be seen from the following table that this variation is much less than in the case of the respective compositions of the mangels as harvested. The only component that is not in the same approximate proportion in both

instances is albuminoids, the variation of which is much smaller in the case of the same variety at the three farms than in the case of the eight varieties grown on the one farm.

TABLE showing the variation in the percentage composition of the dry matter content of certain varieties when grown under different conditions, compared with that of the same varieties when grown under the same conditions.

	Variety.									Farm.			
	Sugar.	Yellow Globe.	Golden Tankard.	Mammoth Long Red.	Golden Globe.	White Sugar Rose Top.	Giant Half Green Top.	Prizewinner.	Average.	Grafton.	Glen Innes.	Hawkesbury Agricultural College.	Average.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Albuminoids ...	6·47	5·00	4·12	2·08	7·07	0·50	3·91	3·74	4·11	11·37	7·05	11·67	10·03
Ether extract ...	·51	·31	·64	·88	·21	·22	·60	·41	·47	·84	·25	·66	·58
Fibre	16·16	4·29	7·24	8·39	10·56	2·69	7·91	3·73	7·62	6·24	8·51	10·81	8·52
Ash	18·47	14·95	9·53	9·77	17·42	10·10	12·73	13·03	13·25	8·09	7·78	22·95	12·94
Nitrogen-free extract ...	41·61	24·30	18·11	22·06	28·71	10·76	23·75	16·79	23·25	22·81	26·39	31·20	26·80

HOT WATER FOR DAIRYING.

HOT water, boiling if possible, is an essential to successful dairying. Without hot water, and plenty of it, dairy utensils, milking machines, &c., cannot be thoroughly cleaned. Too often efforts are made to heat water in a kerosene tin or similar contrivance, stuck out in the yard somewhere near the dairy. In windy or wet weather it is a very luke-warm water that is obtained, apart from the scanty supply and the waste of fuel and time in securing it. Indeed, the scarcity of fuel is ever becoming a greater problem on some dairy farms, and is used very reluctantly for heating water for washing-up purposes. Under these circumstances it is easily understood why dairy utensils are so often not at all clean, and why the milk and cream become contaminated by unclean buckets, &c.

A most satisfactory method of providing a plentiful supply of hot water is the use of an ordinary bath water heater—one that will give 8 to 10 gallons of scalding water in about five minutes. As a rule maize husks, chips, or any light dry material may be used, thus effecting a great saving in fuel. For convenience the heater can be placed on the dairy verandah near the wash-up vat, with the flue projecting through the roof. With such a heater there is always a plentiful supply, after washing utensils, for a final scalding with clear water.

No accessory to the dairy would provide such satisfaction and service, and pay for itself so quickly, as a rapid water heater. It is one of the best investments a dairy farmer can make.—O. C. BALLHAUSEN, Dairy Instructor.

Introducing Queen Bees.

W. A. GOODACRE, Senior Apiary Inspector.

THERE is at all times a good deal of discussion among apiarists regarding the best method of introducing laying queen bees to queenless colonies. Whether the queen is to be placed with stock found queenless, whether she is to take the place of a queen that is undesirable, or whether she has been specially obtained from a queen-raising apiary for the purpose of improving the breed, some careful method of introduction is necessary when she is to be placed with bees that are strange to her, and although practically any of the numerous methods usually advocated are fairly effective if rightly applied, it must be admitted that some risk attaches to each, with the one exception of that method which constitutes introduction to the emerging brood. Since this method is not practicable for general purposes, however, and is only used in the case of valuable queens, the apiarist must introduce the majority of his queen bees in other ways and accept the risk.

Virgin queen bees which have just issued from a queen cell will be accepted by any queenless colony without introduction. Virgins, three or four days old should be introduced similarly to laying queens.

If the season is a good one, and the condition of the bees is prosperous and progressive, introduction can generally be carried out with success. There are short periods during some seasons, however, particularly when there is a dearth of honey, when the bees are in a discontented mood, and supersedure and balling of queens then take place if extensive introduction work is attempted. At such times the temper of the bees may be improved if they are given some stimulating feed. Abnormal swarming periods should, if possible, be avoided for introduction work.

The methods of introducing queens may be discussed under three headings—(*a*) Introduction to emerging brood (used only for valuable queens); (*b*) introduction by the cage method (suitable for the beginner for the introduction of untested queens received by mail); and (*c*) introduction by direct methods (used by the practical apiarist for the introduction of untested queens).

Introduction to Emerging Brood.

When a valuable queen bee comes to hand, examine a number of the most populous and progressive hives in the apiary, and from these select three or four combs, each of which contains a large quantity of sealed brood from which young bees can be seen emerging fairly freely. Two combs containing some honey should also be secured. All the bees should then be removed from all the combs, and the latter placed in a hive body—the brood in the centre and the honey frames each side—and the whole made compact. The hive body containing the combs is now placed above a sound wire-cloth screen over a populous hive. The object of the screen is to allow the heat

from the colony below to penetrate to the brood, and yet at the same time prevent any bees from entering the top storey. The queen and her attendants should be liberated on to the brood combs in the adjusted top storey, and a good close-fitting cover placed on.

When ordering the queen the apiarist should ask that her wings be clipped before dispatch. No risk of losing the queen during liberation should be taken, even if it is found advisable to secure the screen to the bottom of the prepared body; make the combs firm, and carry out the liberating work indoors near a window where the light is good, returning the material immediately afterwards to its position over the populous colony. All material must be close fitting, and the apiarist must make sure at all times that ants cannot gain access to the young colony, for young bees can offer no resistance to attack, either at the time of their emergence or for a while after. In about eight or nine days' time there should be quite a nice little colony with the queen. This colony can then be placed on a new stand and the entrance contracted, so as to allow only one or two bees to pass out at a time, and it should be left so until the bees show a fair amount of activity.

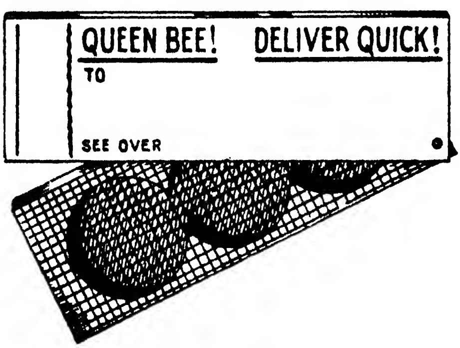


Fig. 1.—Mailing and Introducing Cage.

Another plan is to place the brood and honey in a hive, screen up the entrance (allowing ample ventilation), liberate the queen and her attendants as previously mentioned, and keep the hive indoors in a warm room for a time to allow sufficient bees to emerge before the hive is placed on a stand in the apiary.

Introduction by the Cage.

As already indicated, the cage method is used when introducing untested queen bees received by mail (Fig 1). Directions as to the method of introduction are given on the back of the label attached to the package Those given on the label used by one American firm are reproduced on page 825 (Fig. 3), and the beginner cannot do better than follow these, reserving the direct method for use when his experience is greater.

A few notes in connection with the set of directions reproduced may be of interest :—

1. If a normal laying queen is removed from a hive to make room for the introduction of the queen received by mail, the removed queen can be securely caged and kept above a queen excluder in the upper storey of any populous hive, until the success of the introduction is assured. The bees above an excluder will feed the queen, providing communication is allowed through the wire cloth of the cage.

2. If a colony is made queenless during the morning, the introduction of the new queen should be carried out about dusk of the same day. It is advisable to carry out all introduction work about dusk, so that there will be no robber bees to excite the colony.

3. Very often there is such a large quantity of candy in the cage when received that the queen cannot be released within reasonable time by the bees without assistance. Therefore it is advisable to ascertain the depth of the candy, to do which it may be found necessary carefully to lift up a corner of the wire screen and paper covering over the food compartment (subsequently replacing both screen and cover). If the food compartment under the paper is a quarter full the supply will be about right; if three parts full, then after removing the cork assistance should be given to the bees by loosening the candy about the opening with the point of a nail.

4. When introducing it is very important that the bees in the hive have free communication with the queen and her attendants through the wire cloth screen of the cage. To allow of the best communication many apiarists transfer the queen only (not her attendants) to a Miller cage, the transferring of the queen from the mailing to the Miller cage being performed in a room near a window so as to prevent risk of the queen's escape. Candy is provided in the Miller cage, and to prevent the release of the queen until about the right time a piece of fairly stiff paper is fastened over the candy hole entrance. Through this paper and into the candy a good number of holes should be punched with a pin. Delay in release is ensured by the bees having to chew away the paper before eating out the small quantity of candy.

Fig. 2.—Miller Introducing Cage.

5. A greater measure of success will attend introduction work with populous colonies if they are removed from their stands after being made queenless, and for the purpose of catching the field bees returning to the old stand a frame of brood and some empty combs should be placed in a hive. Toward dusk the removed colony will be minus many of its old field bees and should readily accept an introduced queen. When introduction has been safely performed, the colony is returned to its original stand, and the bees from the hive left to catch the fielders are shaken in front and allowed to run into the old hive. Any queen cells started on the brood that was with the field bees are removed and the brood placed with another colony.

6. A colony that has been made queenless nine days previously and that has had all started queen cells removed, is in an ideal condition to receive an introduced queen. In such a case the bees would be hopelessly queenless, and without a chance of raising one.

7. A small or nucleus colony prepared for introduction work will readily accept an introduced queen, and can be easily united with a populous hive, providing the latter has been queenless for a day. To unite the colonies,

make a space at the side of the brood nest in the populous hive, and carefully insert from the nucleus the combs, bees, queen and all. Leave the colony alone for five or six days after uniting.

DO NOT OPEN HIVE FOR 6 DAYS AFTER INTRODUCING QUEEN.

DIRECTIONS FOR INTRODUCING. Before giving this queen to the colony be sure it is queenless. A stock that has been without a queen from 12 to 16 days—long enough so that there is possibly one or more virgins in the hive, will not as a rule accept of an introduced queen. The colony should not be queenless more than 5 days, and to secure the best results one or two days are better. See that all queen cells that may have been started are destroyed. To introduce with this cage, pry off the cover, note the condition of the queen; pull out the cork in the end, and lay cage on top of the frames, under the quilt. Through the hole in the end the bees will eat out the candy left in the cage, and release the queen in from one to two days. If the bees release her quietly themselves it will be better than if you try to help the thing along. If the weather is cold, set the cage right over where the cluster of bees is. Should the queen and her attendants arrive feeble or daubed up, release her at once right among the bees. If, after they clean her off, they ball her, return her to the cage and introduce her as explained. If she arrives dead, notify the sender, who will replace. If bees are or have been robbing, you may not succeed in introducing. N.B.—Queens just from the mails usually look small and dark. After laying a few days they will improve.

IF YOU KNOW A BETTER METHOD USE IT.

Fig. 3.—Directions sent with each cage by an American firm.

Direct Introduction.

In direct methods of introduction the queen bees to be introduced are placed in direct contact with the bees in the prepared queenless colonies. The success attending this form of introduction is based on the fact that if a queen bee is brought into such a condition that she will not exhibit nervousness when placed with bees strange to her she will almost invariably be accepted, providing, of course, due care has been taken to have the colony prepared. If the plan is reversed, and the bees brought into a similarly tolerant state during the short critical period, the same success will be obtained.

Many apiarists for quite a long time have used direct methods when introducing queen bees from one colony to another in the apiary or from nuclei to large colonies. Lately, however, a number have used direct methods when introducing queen bees received by mail with a notable measure of success. Very good results were obtained at the Government Apiary at Wauchope during the past season with direct methods of introduction, fifty queen bees being introduced without a single loss. I consider that direct methods of introduction are worthy of more attention, especially from practical apiarists, than they at present receive.

The Smoke Method.—In this method the bees are brought to a condition in which they will not notice the queen. The colony to which the queen is to be introduced should be in a queenless condition, as previously mentioned for the cage method. Toward dusk light up the smoker and get a good volume of smoke, add to the smouldering fuel a matchbox top full of tobacco, and as soon as a good strong odour of tobacco is produced from the smoker, contract the entrance to the hive to about an inch and deliver two or three good puffs of smoke into the entrance. Wait a few minutes and give another puff or two of smoke—just sufficient to make the bees set up a roar in the

hive. Open up the hive and deliver over the frames sufficient smoke to remove the bees from the top bars. Then open the cage containing the queen, and allow her to go down between the brood frames, following her up with a puff or two of smoke. The hive is then covered and allowed to remain for twenty minutes, when another puff or two of smoke, which contains tobacco odour, should be delivered into the entrance. Next morning the entrance to the hive is enlarged a little, and the colony not interfered with for about five days.

The Simmins Method.—In this method the operation of direct introduction is made possible by first bringing the queen bee into a state of eagerness and confidence. Just previous to introducing her, the queen is placed in a cage without attendants or food, and kept for thirty minutes in a dark place. The queenless colony is then opened up, care being exercised not to excite the bees, and the queen is allowed to run down between the brood frames. Being hungry and lonely, she will immediately ask for food and will not exhibit nervousness. The hive is closed up and not interfered with for about five days. It will be a sufficient time if the colony has been made queenless for an hour or so before the introduction. In fact, in all direct methods of introduction I have obtained very successful results by just giving sufficient time for the colony to settle down after the removal of their queen before introducing the new queen. About dusk is the best time for this form of introduction also.

There is yet another method which is both simple and effective, and from my experience I cannot see that if the operation is carefully carried out any harmful effect to the queen is produced. The queen in this case is dropped into a cup which contains honey which is not too dense, quickly but carefully covered with the honey, lifted out with the aid of a dessert spoon and allowed to roll down between the brood frames among the bees. The queen thus daubed up cannot exhibit nervousness, and the bees cleaning her up are put in good humour. The work should be carried out about dusk, and the colony need only be queenless an hour or so.

When Bees Ball a Queen.

Bees rarely destroy a queen that they are dissatisfied with by stinging her—their usual method is to pack round her in the form of a ball with the idea of smothering her. Should such a ball of bees be noticed after the queen is liberated (either in introduction or other work), she should be freed by blowing smoke on the ball of bees. To prevent damage to the queen cool smoke should be used.

Another method is to put the ball of bees in water—they will then quickly separate. If the bees ball a recently-introduced queen, it is advisable to make an examination of the hive and remove any virgin, or queen cells, and then introduce the queen again.

LIQUID HYDROCYANIC ACID GAS FOR FUMIGATING TREES.

ALTHOUGH the practice of fumigation for the control of scale insects of citrus trees was regarded with a certain amount of scepticism at the time of its introduction, the efficacy of the method has long since been proved, and there is no doubt that its use is an important factor in the production of clean mandarins, lemons, and oranges. As orchardists are aware, the fumigating medium is hydrocyanic acid gas, which is generated by the action of sulphuric acid on potassium cyanide, and applied while the tree is enclosed in a fairly air-tight canvas tent. The procedure so far recommended by the Department of Agriculture is to place the generator containing the diluted acid beneath the tree, place the tent in position, and to add the cyanide quickly to the acid through a small aperture left temporarily at the foot of the tent.

At a recent meeting of the Sydney section of the Society of Chemical Industry, a paper contributed by Dr. George Harker, of the University of Sydney, discussed the chemical reaction which takes place when sulphuric acid is added to sodium or potassium cyanide. It was stated that as a result of this study of what had hitherto been regarded as a perfectly simple reaction, he had been surprised to find that not more than 30 per cent. of the quantity of gas theoretically obtainable was actually evolved, but if the sulphuric acid were added to the cyanide under reduced pressure nearly the theoretical yield of gas was obtained, and that if a portable generator could be designed, whereby the gas could be evolved under reduced pressure and then delivered for use, the great waste of cyanide at present taking place could be prevented.

Any suggestion for the improvement of existing fumigation methods must be welcomed, and Dr. Harker has doubtless opened up a matter of some importance to fruit growers: but it may be said that the use of liquid hydrocyanic acid gas from a portable generator situated outside the tent was considered by the Department rather more than a year ago. The aim at the time was to reduce any unnecessary wear on the tent material, but the comment of Mr. F. B. Guthrie, Chemist to the Department, may be quoted as applicable in connection with the proposal now under notice :—

" Liquid hydrocyanic acid is made by acting on cyanide with sulphuric acid and liquefying the gas produced under pressure in steel cylinders (like carbonic acid.) When the tap is turned on and the pressure removed the liquid is converted into gas (hydrocyanic acid.) As the gas evolved in this way is dry, it is probable that the tent is less liable to rot than if the gas is given off in the ordinary process, when it is charged with water vapour. The trouble will lie in obtaining the liquefied gas. One of the leading firms of manufacturing chemists has refused to make it on previous application, and it is doubtful whether the demand would be sufficient to tempt any other manufacturer. It would probably have to be imported."

The foregoing quotation seems to make it clear with whom the issue now lies if progress is to be made on the lines suggested by Dr. Harker, and it is understood that the situation remains substantially the same. It may be remarked, in connection with the wear of the tents, that even under the present method of fumigation, if a little care is exercised in adding the cyanide to the acid so as to prevent splashing, and a spreader is used on the generator to distribute the gas evenly, a considerable saving in the life of the tent is effected.—W. J. ALLEN.

Pure Seed.

Growers Recommended by the Department.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

***Maize*:—**	
Golden Glow	J. F. Chick, Hillview, Tenterfield.
Wellingrove (formerly Early Yellow Dent).	Manager, Experiment Farm, Glen Innes. J. S. R. Crawford, Emu Swamp, Orange.
Iowa Silvermine (formerly Silvermine).	Manager, Experiment Farm, Yanco.
Golden Beauty	R. Richardson, Mondrook, Tinonee, Manning River.
Manning Pride	S. Smith, Karaak Flat, via Wingham.
Golden Nugget...	J. W. Smith, Wauchope.
Manning White	A. McM. Singleton, Henley, Sydney.
Large Red Hogan (formerly Red Hogan).	Principal, H. A. College, Richmond.
Craig Mitchell	W. D. K. Humphries, Muswellbrook.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy (formerly Improved Yellow Dent)	D. J. Dorward, Tayfield, Cundletown. J. C. Duff, Mount George. P. Mooney, Dumaresq Island, Taree. W. Richardson, Dumaresq Island, Taree.
Goldmine	A. Louttit, Moruya.
Yellow Moruya	A. Louttit, Moruya.
Golden King	E. Blackburn, Warkton, Coonabarabran.
Manning Silvermine	R. Dyball, junior, Taree Estate, Taree.
***Grain Sorghums*:—**	
Feterita	W. D. K. Humphries, Muswellbrook.
Manchu Kaoliang	Manager, Experiment Farm, Bathurst.
***Millet*:—**	
Japanese	Manager, Experiment Farm, Coonamble.
***Sudan Grass*:— ... ...**	J. Cavanagh, Curlewis.
***Clovers*:—**	
Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
***Kikuyu Grass*:— ... ...**	Principal H. A. College, Richmond. Manager, Experiment Farm, Lismore. Manager, Experiment Farm, Grafton.
***Elephant Grass*:— ... ...**	Principal, H. A. College, Richmond. Manager, Experiment Farm, Lismore. Manager, Experiment Farm, Grafton.

In addition to those tabulated a number of crops were inspected and passed, but as the growers failed to forward samples their seed has not been listed.

The present generation would indeed be surprised if they could see what science and brains will do for agriculture in the next half century.—*Journal of the Ministry of Agriculture* (London).

Poultry Notes.

NOVEMBER.

JAMES HADLINGTON, Poultry Expert.

In every walk of life and in every business it is helpful to success to have an objective, providing it is within a reasonable prospect of attainment. If too high at first such an objective may prove a hindrance rather than a help.

At the present time nearly every poultry-farmer is aiming at high fecundity in his flocks, whilst apparently failing to obtain it. All are keen to possess high producers, and large sums of money and much time are often spent in an effort to improve the productive capacity of the flocks. This is a most commendable effort, but has it produced the desired result?

A Twelve-dozen Objective.

With ordinary stock and good management an average of twelve dozen eggs per hen should easily be attainable without regard to the higher performances at which almost every breeder is aiming, yet how many farmers can show such a flock average? There are some, but not a large number. Why is this so?

Let the poultry farmer take stock of his position, and find out if he is securing his flock's known possibilities—even a modest twelve-dozen average—and if not let him pause to ponder over the cause of his failure to do so. Such failure will not be due to any innate or hereditary low-laying capacity of the breeds, because any of the breeds commonly run on commercial poultry farms are capable—and have been capable as far back as the writer has known them—of putting up a much higher performance than the one mentioned. It amounts to this then, that while making a great effort to secure high production, we are obtaining low, or at any rate quite mediocre performances. The reason is simply because while striving for high production we are neglecting the factors that count most in its incidence.

How to attain our Objective.

First, we must have good rearing, so that birds of good constitution form the bulk of our flocks. Second, we must have some knowledge of selection, sufficient at any rate to cull out the very low producers; these will constitute but a small percentage if the stock has been properly reared, and in such case will probably not be sufficient to pull the average below twelve dozen, even if they are left in. Next, we must give concentrated and skilful attention to the birds, and particularly so in respect of feeding. What should be understood is that high hereditary laying capacity must be inoperative, or fail to function in birds that are badly reared or which do not get the best possible conditions.

Monthly Expectations on the Twelve-dozen Basis.

It will, no doubt, be helpful to the poultry-farmer to be able to trace from month to month the necessary performances of his hens to put up a twelve dozen average for the year. Starting from this month the following will be approximately the monthly averages necessary to secure a flock average of twelve dozen per hen per annum :—

November ...	17 eggs per hen.	May	4 eggs per hen.
December ...	16 ,, ,,	June	6 ,, ,,
January... ...	13	July	10 ,, ,,
February ...	11	August	16 ,, ,,
March	7	September ...	19 ,, ,,
April	6	October ...	19 ,, ,,

In visualising what a twelve-dozen average means in net return, the farmers must calculate upon the average price of eggs per dozen, and of cockerels per pair, and not for this, or any particular month, but on the average prices over the twelve months. This is mentioned because many beginners are prone to take a superficial view and to aver that poultry-farming would not pay on a twelve-dozen basis at the present price of eggs—1s. 6d. per dozen—whereas the average for the year will probably reach 2s. per dozen.

Seasonal Expectations.

During the last two months egg-production will have reached its highest point, and, in consequence, prices should have reached their lowest. From this month onward we can look forward to a gradual falling off in production, with a hardening in prices. These are seasonal expectations, but by close attention to the birds, and by good skilful feeding, the downward tendency in production can to some extent be arrested, or at any rate be less rapid than it might otherwise be. During August, September, and October, almost any hen will lay, and production is maintained with much less attention and skill on the part of the poultry-farmer than is required at other seasons of the year.

We are now entering the period when it is quite a common occurrence for poultry-farmers to experience a sharp falling off in production, the result, in most cases, of a complacent attitude in the management of the flocks, which has been engendered by the easy production of the previous months. A reminder that it will require more skill and attention to the laying stock to prevent an undue falling off in production from now on, will, it is hoped, prove profitable to many. Any neglect now will lead to a sharp falling off in the egg-yield.

Skilful Feeding Required.

Just throwing to the birds their usual allowance of food is not calculated to produce the best results. The appetites and moods of the birds should be carefully noted and met with by skilled attention, and not by rule of thumb measures designed to cut out or save labour. It is the farmer who studies his birds and puts the necessary amount of work into his flock that will obtain the maximum results of which his birds are capable.

Skilful feeding does not consist in stinting the birds of food, so they may not get too fat. This is one of the fallacies of the poultry man which die hard. In my travels around farms, this idea is found in numerous cases to be one of the principal causes of a sharp falling off in egg-production. If there are fat hens in the flock which are bad layers (and there are many fat hens that are good layers) there is only one remedy—to cull them out. The whole flock must not be stinted, however, because a small number of fat hens has to be dealt with, or the egg-yield will be reduced. It is only by feeding with good food all that the birds will eat, and just the amount necessary without leaving a surplus with which the hens become surfeited and stale of appetite, that we can get the maximum result. The best poultry feeders are those who, while afraid to waste their food, are yet equally afraid that the hens might not have sufficient to maintain their maximum ability to produce.

Change of diet is another matter to be careful about. Change in the food itself, or the preparation of it, is calculated materially to reduce egg-production at any time, but particularly so when it is seasonally on the wane.

Don't Neglect the Broodies.

The neglect of broodies may seem a small matter, but it has an important bearing on egg-production. During the late spring and summer months broodiness reaches its maximum, and where there is neglect or failure to handle the hens properly as they become broody (both in getting them off the nests and in returning them to the yards again) there is a great loss of potential egg-production. In dealing with broodies, it has to be remembered that every day that a hen is allowed to remain on the nest after it becomes broody induces her to become more confirmed in her broodiness, and the longer it will take to get her off it. Arrangements should be made that at each evening's gathering of eggs any hen found on the nest should be at once removed to the quarters for broody hens, preferably crates with slatted bottoms. This work should be systematised in such a way that the newly-broody hen can be distinguished from those which have become normal.

This can be done, either by putting distinguishing bands on the legs, or by separation in the crates of each day's broodies. Different farmers have different methods of dealing with broodies, but this reminder will apply to all. The main idea is to get the hens over their broody propensity in the shortest possible time, so that they can be got back to the business of laying eggs.

The excuse generally put forward to account for a whole bevy of broody hens on the nests is that they will still lay some eggs, but it is false economy, because for every egg so layed the farmer probably loses half-a-dozen through letting the hen remain on the nest so long.

Another excuse set up is that if they lay in the broody quarters the hens learn to eat eggs. The facts are that any hen will eat an egg when once broken, but few hens learn actually and deliberately to break eggs. Accidentally broken eggs are therefore not the menace that many beginners imagine them to be.

Another important feature in this connection is that, as we enter upon the months now under review, hens that have been allowed to get properly broody and to sit for weeks will very often go into an early moult with the result that the laying for the season is finished.

The factors mentioned above are calculated to have an important bearing on egg-production at any time of the year, but particularly so in the summer and autumn.

Good Shell Grit a Necessity.

It might appear very simple to remind poultry keepers of the necessity for attention to the supply of good shell grit, and that any shortage of this commodity will not only result in soft-shelled eggs, but in a sharp reduction in quantity. Space in these notes will not permit me to go into all the physiological reasons for this, and in any case universal experience is quite sufficient on the point. But it is necessary to point out that the fallacy is common among beginners and small poultry-keepers that as lime is a necessary requirement it can be given in any form, and that as grit is required any kind of grit is good enough. The primary function of shell grit is to supply the mineral matter for shell-making material, hence the laying hens will eat more of it than the male birds, the latter requiring just sufficient to assist the digestion of fibrous material in the gizzard. For this purpose sharp grit of almost any kind is of some service, but the grit necessary for laying hens must consist principally of carbonate of lime, and the most ready form of this is beach shell or oyster shell, which should be crushed to a size conveniently for hens to swallow. A mixture of one-third of the latter to two-thirds of the former is about the best for the purpose, but burnt lime should not be given, nor should it be put into the drinking water.

A Pest of Orange Trees.

"I AM posting two specimens which I hope you will be able to enlighten me about," wrote a correspondent who had discovered suspicious conditions on his young orange trees. "The caterpillar was on the leaves, and the other specimen seems part of the tree unless studied very closely. It was fastened on to a perpendicular limb of the tree by the tail end, and there was a silky substance round, also, which helped to attach it securely."

The specimens in question were the caterpillar (larva) and chrysalis (pupa) of the smaller orange butterfly, *Papilio anactus*. The adult insect lays the eggs on the tender leaves of the orange, upon which the caterpillars feed. When full-grown the caterpillar attaches itself by a silky material from the tail end to the food plant and pupates, the pupa being also supported by a silken thread round the centre. The adult insect is a smoky black butterfly with dark brown wings, ornamented with large white patches and small red spots. If the caterpillars are in large numbers they can be destroyed with arsenate of lead spray (2lb. to 50 gallons). Otherwise they should be picked off by hand.—T. McCARTHY, Assistant to Entomologist.

Orchard Notes.

NOVEMBER.

W. J. ALLEN and W. le GAY BRERETON.

THE winter generally throughout the fruitgrowing districts has been one of ample rainfall, and provided the grower has had his land ploughed early the subsoil should be well soaked and moisture thereby stored up for the coming season. From now on throughout the summer, every effort should be made to conserve moisture for the trees and to check needless evaporation by keeping down weed growth and stirring the surface after rain. Not infrequently one sees that part of the land which can be easily reached by horse implements in good order, but the inaccessible parts under the trees neglected. This is a bad practice, and has a deleterious effect upon the trees, especially young ones.

Summer Thinning and Training of Young Trees.

Those who have young deciduous trees in their second year should spare some time for summer thinning. The energy of the tree can be directed and made greater use of by a few intelligent cuts. Leaders can be forked and spaced, and directed to fill in empty spaces. All rank growth in the centre should be removed, and many of the coarse outside shoots (unless intended for permanent wood) can be suppressed, though care must be taken not to be extreme.

Often trees for the first five or six years, and even longer on strong soils and under favourable conditions, continue to make over-strong and very dense growth. Such trees should be thinned out by removing some of the strong shoots that will not be required for the future development of the framework of the tree; otherwise the smaller growth on the lower parts of the framework will be too shaded and will not develop sound fruit buds. At the same time, this thinning of the tree should be done with caution, for it can be overdone, and will then have a harmful effect.

Where stocks (either nursery or "re-work") have been cut back to start inserted buds or grafts, they should be disbudded. On established re-worked trees it is advisable to leave some shoots from the old part; they should be checked by pinching them back so that they will not rob the shoots from the inserted buds or grafts, but only serve as shade to the main arms and trunks, and also draw the sap.

Water shoots should be taken out. Very often vigorous shoots in citrus come away from main branches. These may occasionally be made use of in building up the tree if they are in suitable positions, but they should be

topped to encourage lateral growth. Long heavy growth, carrying heavy leaves on the outside of the young tree, causing it to droop and twist, should be cut back to an upward shoot or bud.

Thinning of Fruit.

Some of the early setting apricots, plums, and peaches will have completed their final shedding, and where the remaining fruit is too thick they should be thinned out to allow the remainder to develop to a good size.

The grower should discriminate in carrying out this work, starting on those that set and shed early, leaving the later varieties for a few weeks, and it must be borne in mind there is generally a second drop after the regular shedding following the setting.

Diseases and Pests.

The first or calyx application for codlin moth in apples and pears is generally finished by the end of October. Sometimes when blossoming occurs over a long period it is necessary to make the application before all the petals have fallen from the later blossoms, in order to catch the calyxes of the early blossom before they close. In such cases the trees should have a second application when the later blossoms have fallen and before their calyxes have closed. This refers to the early and late blossoms on one tree, not to the varying periods of blossoming of different varieties.

The regular second application of arsenate of lead should be made when the apples and pears have swollen to some extent—about four to five weeks after the petals fall.

With proper precautions soap can be added to lead arsenate as described in these notes last season. This causes the lead arsenate to spread better over the fruit, and assists in keeping down woolly aphis.

If wet or showery weather sets in, precautions will have to be continued against black spot of apple, pear, and grape vine, also against downy mildew and oidium of the grape vine. Departmental leaflets for the treatment of these diseases may be obtained on application to the Under Secretary and Director, Department of Agriculture, Sydney.

In districts where the apple is subject to mildew, attention should also be continued for control of this disease, using either atomic sulphur or atomised sulphur combined with each application of lead arsenate at the rate of 1 lb. to 10 gallons of spray. Full particulars for the treatment of this disease can also be had in leaflet form on application.

Where black aphis is attacking peaches, Japanese plums or apricots, spray at high pressure with tobacco wash (a leaflet regarding which may be obtained from the Department), or one of the commercial nicotine extracts, such as "nicotox" or "black leaf 40," holding the nozzle close to every affected part to break up the clusters of aphis.

If within two or three days after spraying any aphis are alive, repeat the application before the remaining aphis can breed up.

NOTES FOR MURRUMBIDGEE IRRIGATION AREA.

The spraying of vines for downy mildew and black spot should be carried out with thoroughness and at close intervals if the weather conditions favour the disease. Be sure to use freshly slaked stone lime. Suitable lime might be held over if kept in air-tight tins. Fresh lime is essential for the making of Bordeaux mixture.

The spraying of citrus for scale pests can be carried out at the end of this month. The new growth will be hardened off and fruit set. To avoid extreme heat, cloudy days should be chosen for the operation or the latter part of the day. When spraying, see that the soil is in a moist state. If the land is dry and trees in need of a drink the spray is liable to do harm: miscible oils might be used, and a little soap extract (say 2 teaspoonfuls to the pint of oil) will reduce any risk of free oil.

Resin, caustic soda, and fish oil is a good spray and easily made. To make 100 gallons of spray use 5 lb. caustic soda (98 per cent. quality), 16 lb. resin, 3 pints fish oil, 100 gallons water.

In applying either of these sprays we would recommend a trial on a few trees to test results as regards injury. If fish oil is not procurable substitute 4 lb. common soap.

The second spraying of all pears, apples, and quinces with arsenate of lead for codlin moth should be made early this month.

See that no weeds are allowed to grow in young orchards or vineyards during summer months. Frequent thorough cultivations are essential from now on. They help to conserve moisture, and trees and vines always do better where the soil is deeply worked.

SORREL ON WHEAT LAND.

"COULD you supply me with information as to the efficiency of lime for killing sorrel on wheat land?" wrote a correspondent. "The land in this locality, after a few crops, gets badly infested with sorrel, and very bad patches will grow nothing at all in a wet season." The writer was informed by the Chief Inspector of Agriculture that the application of lime to wheat would not be profitable, as a suitable dressing would cost about £3 per acre. The better plan would be to fallow thoroughly and to sow wheat early, applying with it, at time of sowing, about 56 lb. superphosphate per acre. Sheep were also very useful and were, in fact, essential, if sorrel and other weeds were to be kept in control.

MILK is, undoubtedly, the most important of all foods for animals. It appears to be deficient only in iron, which may be more or less adequately supplied by ordinary water. Furthermore, it has been shown by Burge that there is a plentiful supply of iron in the body of the young suckling animal, so that the deficiency in milk may be supplemented from this store. —D. G. O'BRIEN in the *Scottish Journal of Agriculture*.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1921.

Society.	Secretary.	Date.
Tweed River A. Society	T. M. Kennedy	Nov. 16, 17
Lismore A. and I. Society	H. Pritchard	,, 23, 24

1922.

Society.	Secretary.	Date.
St. Ives A. and H. Association	A. K. Bowden	Jan. 13, 14
Albion Park A. and H. Association	H. R. Hobart	,, 20, 21
Kiama A. Society	G. A. Somerville	,, 25, 26
Wollongong A., H., and I. Association	W. J. Cochrane	Feb. 2, 3, 4
Inverell P. and A. Association	A. L. Varley	,, 7, 8, 9
Shoalhaven A. and H. Association	H. Rauch	,, 8, 9
Central Cumberland A. and H. Assoc. (Castle Hill)	H. A. Best	,, 10, 11
Southern New England P. and A. Association (Uralla)	H. W. Vincent	,, 14, 15, 16
Nepean District A., H., and I. Society (Penrith)	C. H. Fulton	,, 16, 17, 18
Dapto A. and H. Society	J. T. Geeson	,, 17, 18
Rydal A., H., and P. Society	S. B. Prior	,, 18
Guyra P., A., and H. Association	P. N. Stevenson	,, 21, 22
Moruya A. and P. Society	H. P. Jeffery	,, 22, 23
Dorrigo and Guy Fawkes A. Association	A. C. Newman	,, 22, 23
Newcastle A., H., and I. Association	E. J. Dann	,, 22 to 25
Robertson A. and H. Society	E. S. Martin	,, 22, 23
Tahmoor Branch of A. Bureau	E. S. Key	,, 24, 25
Tenterfield A. Society	E. W. Whereat	Feb. 28, Mch. 1, 2
Tumut A. and P. Association	T. E. Wilkinson	March 1, 2
Manning River A. and H. Association	R. N. Stow	,, 1, 2
Bega A., P., and H. Society	H. J. B. Grime	,, 1, 2
Braidwood P., A., and H. Association	R. L. Irwin	,, 1, 2
Oberon A., P., and H. Association	C. S. Chudleigh	,, 2, 3
Berrima District A., H., and I. Society	W. Holt	,, 2, 3, 4
Blacktown and District A. Society	J. M. McMurtrie	,, 3, 4
Yass P. and A. Association	E. A. Hickey	,, 7, 8
Glen Innes P. and A. Society	Geo. A. Priest	,, 7, 8, 9
Kangaroo Valley A. and H. Association	L. W. Vance	,, 8, 9
Campbelltown A. Society	J. T. Deane	,, 10, 11
Gundagai P. and A. Society	A. J. Fuller	,, 14, 15
Mudgee A., P., H., and I. Association	S. H. Somerville	,, 14, 15, 16
Armidale and New England P., A., and H. Assocn.	A. H. McArthur	,, 14 to 17
Cobargo A., P., and H. Society	T. McKennelly	,, 15, 16
Barraba P., A., and H. Association	C. E. Williams	,, 15, 16, 17
Luddenham A. and H. Association	L. W. Eaton	,, 17, 18
Tamworth P. and A. Association	F. G. Callaghan	,, 21, 22, 23
Hunter River A. and H. Association (Maitland)	J. S. Hoskins	,, 22 to 25
Camden A., H., and I Society	C. C. Irving	,, 23, 24, 25
Goulburn A., P., and H. Society	F. D. Hay	,, 23, 24, 25
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	April 5, 6
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 10 to 19
Narrabri P., A., and H. Association	E. J. Kimmerley	May 3, 4
Clarence P. and A. Society (Grafton)	L. C. Lawson	,, 3, 4, 5, 6
Lower Clarence A. Society (Maclean)	E. D. Munro	,, 10, 11
Dungog A. and H. Association	W. H. Green	,, 10, 11, 12
Murrumbidgee P. and A. Association (Wagga)	A. F. D. White	Aug. 22, 23, 24
Temora P., A., H., and I. Association	A. D. Ness	Sept. 19, 20, 21

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Agricultural Gazette of New South Wales.

A Farmer's Wheat Yields.

FALLOWED AND NON-FALLOWED LAND COMPARED.

H. BARTLETT, Inspector of Agriculture.

FOR twenty years the Department of Agriculture has urged upon the wheat farmers of New South Wales the system of cultivation popularly known as "fallowing." The response has often seemed disappointingly small, but there have always been those who—good season and bad season—have been able to point to the practical results of the system and to declare that the bank-book furnished the most convincing evidence. To-day there are hundreds of farmers who each year take time by the forelock, beginning the preparation of their wheat paddocks months in advance of seeding, while hundreds of others, prevented by circumstances from putting the system into practice, freely admit that it offers them more certain and better profits if they could but do so. Slowly, no doubt, but surely, the Department's propaganda has borne fruit, and to-day not only is it possible to point to the altered attitude of farmers towards the idea of fallow, but it is reasonable also to claim that better cultivation methods have been a factor in the improvement of the yield of wheat, which, notwithstanding the extension of wheat-growing into districts once regarded as quite unsuitable, has been apparent in recent years.

The change of feeling quite evident among farmers to-day can only have taken place under the influence of hard facts—the hard facts of crops that have weathered through dry spells more healthfully and more attractively than others nearby, and that have filled more bags and returned more money. The experiment plots conducted in conjunction with the Department by many private farmers in all parts of the wheat belt during the past ten or twelve years have been a material factor in the change. The plots have been conducted with the definite object of proving that increased yields may be expected from improved methods and improved varieties, but the practical limitations of the average farm have never been lost sight of, and the fallow has only been cultivated when an increased monetary return could reasonably be looked for.

Calculations carefully made within the Department show that the average yield from these farmers' experiment plots for five years was approximately 20 bushels per acre per annum, whereas the yield of the whole State for the same years averaged just 12 bushels. When it is recalled that on the farmers' plots some varieties are tried that ultimately fail to reach the average of adjoining varieties, and that sometimes fertilisers and other methods have been tried that have also depressed the returns, the logic in favour of the

outstanding feature of the plots—fallow—is indisputable. In the plots the Department is able to point to a mass of valuable information, and to advocate modern methods with more confidence than ever.

There is no doubt, too, that the indirect benefit attaching to the establishment of farmers' experiment plots has already been enormous. Throughout the wheat districts a better farming practice is springing up around these plots, and a comparison of the yields obtained on the plots with the average yield of surrounding crops will generally show what a tremendous uplift to the agricultural prosperity of the State would result if the methods demonstrated were practised by all farmers.

But behind the results obtained on these plots, there has also been, as already indicated, a solid and increasing body of men who have adopted fallowing as a regular feature of their farm practice, and who have done so for that best of good reasons—that it pays. The value of such men to their districts as factors in improving local methods is real indeed, but where one of this class has kept records of his returns for a number of years, and has carefully distinguished between fallow and non-fallow, the evidence can only be esteemed most valuable.

Such a record of results—such a useful and convincing comparison, Mr. W. W. Watson, of "Woodbine," Tichborne, near Parkes, has generously made available for the benefit of his fellow wheat-growers. Mr. Watson, of Victorian parentage and training, settled at "Woodbine" in 1902—a bad year to start—acquiring as conditional purchase and special lease a farm of 1,200 acres, of which only some 50 acres had already been cleared. Victorian associations had already inculcated the value of good methods, and for the first sowing 30 acres were fallowed and another 55 acres planted on briefer preparation.

But those were days of small things at "Woodbine," for plant and other things were not too plentiful, and with the exception of 70 acres in 1906 no more fallowing was done for four years. As things improved, however, and resources increased a regular application of the system became possible. and since the year 1908 Mr. Watson has always had a proportion of his wheat under fallow, and year by year the proportion has increased, until latterly the larger part of the area, and in some years the whole, have had that thorough preparation. That the results have been profitable the accompanying table affords very substantial evidence, but a walk round the farm—now increased to 1,800 acres of conditional purchase and additional conditional purchases, and the first portion almost freehold, with its comfortable homestead, its well-fenced paddocks, its substantial reserves of water lifted by windmills and reticulated to all paddocks—the conviction deepens that farming in the central west still offers solid attractions.

The accompanying table shows the cropping on the farm, and needs little by way of comment. Its facts are, indeed, outstanding and instructive.

AREA cropped at "Woodbine," 1903 to 1920, showing wheat sown on fallow and stubble separately.

Year.	Wheat. Fallow. Area.	Wheat. Fallow. Average Yield.	Wheat. Stubble. Area.	Wheat. Stubble. Average Yield.	Wheat. Hay. Area.	Wheat. Hay. Average Yield.	Oats. Area.	Oats. Average Yield.	Rainfall. On crop 1 April to 3 Nov.	Rainfall. Total for year.
	acres.	bush.	acres.	bush.	acres.	tons.	acres.	bush.		
1903	30	26	55	23	15	2	20	40	12·50	19·50
1904	...	...	125	8	30	½	25	24	10·90	16·45
1905	...	...	150	13	20	1	...	...	12·30	20·30
1906	70	22	180	12	32	1½	18	32	17·35	25·55
1907	...	...	200	5	70	¾	30	20	7·70	18·60
1908	50	12	140	5	130	1¼	...	...	6·20	14·16
1909	110	23	130	20	20	1½	60	36	10·20	15·31
1910	120	21	160	10½	55	1	10	16	8·42	19·18
1911	85	17	90	10	55	1	20	25	6·60	21·00
1912	210	28	85	23	65	2¼	50	41	13·35	15·78
1913	245	15	80	6½	30	1	45	12	8·28	14·58
1914	210	8½	100	2	65	¾	25	19	5·63	14·68
1915	400	16½	... †	...	10	1¼	25	26	10·07	14·12
1916	370*	10	80	12	35	1½	45	40	19·30	28·29
1917	250	21	80	10½	35	1½	35	47	13·42	23·29
1918	200	19	...	...	20	1½	30	10	9·00	14·22
1919	45	10	125‡	3	80	½	30	3	6·75	15·60
1920	120	36	300	21	20	2	50	36	12·00	19·02

* 50 acres destroyed owing to excessive rains.
† 40 acres failed owing to drought.
‡ 80 acres failed owing to drought.

In compiling these figures the areas that failed have been included in the averages. In favourable seasons the hay was chiefly cut from the boundaries of crops, but in dry years it was taken off the fallow. Oats were mostly grown on stubble.

It will be interesting to present another comparison:—

Average yield per acre on *fallow*	17 bushels 51 lb.
" " " *stubble*	11 " 44 "
Increase of fallow land over stubble	52.1 per cent.

If we turn to a consideration of the details of the table, the consistent excess of the "fallow" yield over the "stubble" yield is most interesting. The year 1906, for instance, must have been a most instructive one to the farmer himself. The 70 acres of fallow averaged 22 bushels, while the 180 acres on stubble land only gave 12 bushels. Again, in the bad years of 1914 and 1919, the fallow land amply paid the cost of production with 8½ bushels and 10 bushels respectively, whereas the stubble land only gave 2 bushels and 3 bushels respectively. In 1919 practically every non-fallow crop in the district failed. Even in a wet season like 1920, when the stubble land had a rainfall of 12 inches during the growth of the crop the fallow land still yielded over 70 per cent. more, although in the stubble land are included areas that failed in 1919 and that, being sown again in 1920, had the advantage

of a sort of accidental fallow. Only in one year (1916) did the fallow show to disadvantage, and then the growth was so heavy that when 13 inches of rain fell in the four months, September to December, the crop lodged and only portion could be harvested, whereas, on the unfallowed land the crop was lighter and could all be saved. It was an experience shared by a good many farmers that year.

The hay yields have been consistently good, and Mr. Watson has only once had to buy chaff; that was in 1920, the result of over-selling in the previous year under the temptation of a high price.

Some idea of Mr. Watson's methods is afforded by the history of two crops of Turvey wheat which, in the middle of October this year, promised to run 30 to 35 bushels per acre. The first 120 acres, was fallowed in July, 1920, cultivated in February, and worked with the spring-tooth cultivator at sowing time in the third week in April; 50 lb. seed was used and no superphosphate. The soil is a fairly light red loam, and does not require too much cultivation, experience showing, in fact, that it is better left in the rough as long as possible, as it preserves a fair mulch in that condition. The paddock has carried about eleven crops in the last fifteen years. In 1907, when the greater part of this paddock was cleared, some 40 acres had already been cleared and cultivated by the former settler, but it had become very dirty with wild oats. However, wild oats are not a terror to Mr. Watson. His paddocks may truthfully be described as exceedingly clean: it is his view that on such land as his it is possible, with an average rainfall, to get rid of oats in two years, and even on heavy land it should be possible in another year or so.

The other crop of Turvey consists of 50 acres. It had been ploughed in August, 1920, and sown on 1st October with Sudan grass, which, however, was a failure and was grazed off. In February, the one-way disc was run over the paddock, and in May the spring-tooth cultivator was followed by the drill with 50 lb. seed to the acre. In sowing the Sudan grass, 56 lb. superphosphate was used, and no doubt the residual effect has been in favour of the wheat, while the extra cultivation in connection with the Sudan that failed has also been an advantage. The paddock has carried about ten crops in fourteen years.

A word may be interpolated about the Turvey wheat. It was selected from an old Purple Straw variety by a Victorian farmer named Turvey, and it had done so well in the southern State that Mr. Watson brought a few bushels of it with him from Victoria, and sowed it in the first year—1902. The result was almost a failure, but 3 bushels were flailed from the crop, and from that small quantity has been grown all the Turvey wheat now produced in the district. As a variety it seems to give consistently good results, being of fairly long season, and furnishing both good hay and grain crops.

The value of clean, well-graded seed is fully understood here. In the shed is a grader with an improvised but quite satisfactory elevator, by which the

grain is filled into bags instead of being allowed to form a heap on the floor. At hand is a small oil engine that drives the grader, and hundreds of bags of seed are graded yearly for use on the farm, and also on other farms in the district. "To grade your seed is the only way to keep your paddocks clean," is Mr. Watson's doctrine, and a sound and self-evident one. Moreover, the paddocks selected for seed purposes are carefully "strangered," and it is rare indeed to see a plant of a wrong variety in the paddocks.

Sheep have been a feature on this farm from the very beginning. A start was made with 700 in 1902, but 300 were lost in the drought. It was a severe item then, no doubt, but mixed farming (live stock in conjunction with wheat) was a method that must win through, and to-day 400 to 500 ewes and their lambs, with a few dry sheep, are regularly run on the farm. Merino ewes are preferred, but sometimes a few crossbreds have been grazed, and latterly the policy followed has not been to sell the lambs as "fats," but to keep them until nine or ten months' old and then to sell them as stores. Mr. Watson considers that a 1,200-acre farm, with 400 to 500 acres under wheat, plus stubble, should be able to carry 500 to 700 sheep, with their lambs, and perhaps thirty-five to forty head of large stock as well. If fodder crops are grown the carrying capacity should be larger—a remark, by the way, that recalls Mr. Watson's own increasing interest in fodder crops as a feature of wheat and sheep farming. Experience is indicating to him the necessity for maintaining the humus content of the soil, and he has before him at the present time a proposal to grow sufficient fodder crops every year to bring the whole wheat area under such treatment once in every six or seven years.

The Department's interest in such a farm cannot but be an appreciative one. The records quoted and the present condition of the property afford most practical and valuable evidence of the soundness of the methods which for years all officers have urged upon the farmers of this State, and which we must continue to insist upon as essential to ultimate success.

The Maize Ear Worm—A Formidable Pest.

The adaptability of certain insects and their capacity to inflict extensive damage under a variety of conditions could hardly be better illustrated than by what is known in the maize belt of the United States as the corn ear worm, and in the cotton belt as the cotton bollworm. One and the same insect, it is one of the most omnivorous and destructive of all insect pests. It has lately been found a serious enemy of vetch when the crop is raised for seed in the south, and it is also known to feed on tobacco, lucerne, tomatoes, and occasionally beans, pumpkins, peanuts, cowpeas, asparagus, and sunflowers, leaving these crops when opportunity offers to attack those with which its name is more directly connected. Deprived of other food, caterpillars (at which stage all the damage is done) actually devour one another.

Rice Trials at Yanco Experiment Farm.

A trial of several varieties of rice, under irrigation, was carried out at Yanco Experiment Farm last season. The system adopted was continuous flooding, the plants being kept partially submerged from the time they were a few inches high until just before the crop was ripe, the water being gradually raised during this period until a height of 6 inches was reached. This, of course, necessitated accurate grading, and the provision of levees or check banks. A small out-flow was also necessary, in order that the water might not become stagnant.

A Rice Crop at Yanco Experiment Farm.

The several varieties made splendid growth, the most promising being Takasuka, a Japanese variety; but the trial had been planted rather late (8th December, 1920). and a frost in April did considerable damage, so that expectations in regard to grain yield were not realised. A sample of the paddy rice was prepared by a local milling firm, and the quality of the product was very favourably commented upon by them.

The trials are being continued this year, and planting has already been carried out. The Department is not at present in a position to recommend rice as a crop, but at the end of this season's trials hopes to have figures which farmers interested should find useful.—R. G. Downing, Senior Experimentalist.

Elephant grass should be fed off when a couple of feet high; stock then invariably eat it. If chaffed, the grass should be cut before 6 or 7 feet high. Horses and cattle both seem to prefer it in the young stages.—E. Breakwell, Agrostologist.

Wagga Growing-crop Competition.

[The Murrumbidgee Pastoral and Agricultural Association, Wagga, again held a growing-crop competition, and, with the approval of the Minister of Agriculture, Mr. A. H. E. McDonald, Chief Inspector of Agriculture, acted as judge. The following extracts from the report furnished to the President and Committee of the Association by Mr. McDonald are published for general information.—Ed.]

The number of entries this year was thirty-two, which, I understand, is greater than that of any previous year, and is an indication of the interest taken by farmers in the competition. The crop areas ranged from 180 to 600 acres, the aggregate area being 10,366 acres.

The awards are as follows :—

Best farm of growing crops—T. V. and R. L. Brunskill, Lake Albert, 1; A. A. Wilson, Old Junee, 2.

Best 100 acres of wheat on fallow to be harvested for grain—Mrs. A. Lewington, Uranquinty.

Best 100 acres of wheat for hay—Mr. W. R. Lyons, Wagga Wagga.

Best 25 acres of oats—Messrs. T. V. and R. L. Brunskill.

The general high standard of the crops rendered judging most difficult, and it was only after very close examination that it was possible to determine the winning crops. This was particularly the case in the class for the best 100 acres of wheat for grain, no less than thirteen fields being very close together.

Messrs. T. V. and R. L. Brunskill's crop, taken all round, was a very fine one, and is indicative of their skill as farmers, particularly in view of the fact that a considerable area of their land had been worked for many years. The wheat sown on stubble promised only a fair yield, and some wild oats were showing in it, but such crops were found on all farms, and in every case were much lighter than crops on fallowed land. Turvey, Warden, and College Purple, grown on fallowed land on this farm, were particularly good. The crop of oats was very good, being dense with a fine clean straw and little undergrowth. These gentlemen firmly believe in working the fallows thoroughly, and the growth and cleanliness of the crops show that their practice is sound.

Mr. A. A. Wilson's crop at Old Junee was of high merit, and differed from that of Messrs. Brunskill's by very little. This land has also been under crop for many years, and it is noteworthy that practically the same methods are followed, namely, early ploughing, spring working of the fallow, and frequent cultivation in the autumn. Careful attention is also given to the selection and grading of seed.

Mrs. Lewington's crop of College Purple was of exceptional merit. It was very true to type, free from weeds and disease, dense and very even. Very careful attention has been given to the fallow with the result that the crop was almost perfect. This variety seems to be almost an ideal wheat for the Wagga district, as. it is a high grain-yielder and also gives an excellent return of hay. It is, however, somewhat pale in the straw.

Mr. W. R. Lyons' 100 acres of wheat for hay, consisting of Warden and Zealand, was, I think, one of the finest crops it has ever been my pleasure to inspect. The land was last under crop in 1918 and was grazed with sheep until July, 1920, when it was ploughed for fallow, and it was cultivated during the spring and autumn. The crop was exceptionally heavy, dense, fine in the straw and clean. The Warden stood up well, but Zealand was lodged slightly in some low lying spots. This excellent crop is a strong indication of the value of grazing with sheep as a means of improving the fertility of the soil.

Some General Observations.

The inspection of such a large acreage and of so many farms afforded a unique opportunity of observing the methods of farming practised in the district, and with your permission I will refer briefly to the different points which attracted my attention. I do so with the object of focussing attention on the methods adopted by men who have proved their skill as farmers by their crops, and with the object of provoking discussion which may lead to further improvement. It is, of course, difficult to take up this role, for farming practice must be based upon average conditions, and it is only after much experience of conditions as they exist locally that any definite satisfactory system can be devised.

Generally the standard of farming appears, as compared with the other districts, to be very high. It is very satisfactory to note that a very large proportion of the land is under fallow, and that a considerable part of the fallowed land shows evidence of being carefully worked. From close observation it would appear that in many parts of the district the amount of fallow is almost equal to the area under crop. Approximately 70 per cent. of the crops inspected were grown on fallowed land. This represents a considerable increase during recent years.

The difference between crops grown on fallowed land and those grown on stubble was most remarkable. Leaving out specially favoured parts of the district, that is, the section of the Tarcutta-road and around Toolis Creek, it might be safely said that, while the crops grown on fallow were exceptionally good, those grown on stubble were so light that they could hardly be profitable. On every farm some of the crop was grown on stubble and in every case the contrast was most marked. In quite a number of cases the crop grown on fallowed land looked like giving a yield of close up to 35 bushels per acre, while on the stubble the yield would not be more than 12 or 15 bushels per acre. Considered as hay crops, the contrast was

even greater, as some of the crops on fallowed land would return from 2½ to 3 tons, while on stubble the yield would be from 15 cwt. to 1 ton. Quite a number of farmers express the opinion that they were convinced that the growing of wheat on stubble is unprofitable, and announced their intention of sowing only on fallowed land in the future.

Close examination of the crops brought out the following points in regard to the preparation of the land :—

1. Early ploughing for fallow gives better results than ploughing late—about September.
2. Spring working of the fallow leads to heavier yields, while the crops suffer less from take-all.
3. Fallows worked soon after harvest produce heavier crops than fallows which received later workings.
4. Stubble land ploughed soon after harvest gives much heavier yields than land ploughed late.

It is necessary to bear in mind that the past season was exceptional in regard to rainfall. The records show that the rainfall before harvest was normal, while November and December—the harvesting months, when farmers can give no attention to the fallow—were also very wet. Last spring working conserved the moisture from the spring rains, while cultivation immediately after harvest loosened the soil set by the harvest rains. It is noteworthy that the keenest farmers realised the necessity of cultivation, while poor crops indicated that many have shown neglect in this respect. The skill of the farmer lies in his power of adapting his methods of cultivation to the conditions of the season, and I am of the opinion that these competitions have been of very great value in drawing the attention of farmers to the methods adopted by the most progressive men.

A decided advantage of fallowing is that it enables seed to be sown at the right time. The preparation of the land is spread over a longer period and the farmer is not rushed with the work late in the season. If he has a fair area of fallow and wishes to sow on stubble, the land can be worked early. Where fallowing had not been done, or where the fallow had not been carefully cultivated, the ploughing of the stubble land was delayed, and sowing was seriously interfered with by rain.

Under any circumstances April or May sowing can be expected to give the best results in the Wagga district. Late sowings are undesirable, but when in addition heavy rains occur in June and the seed is sown on wet boggy land, it is extremely unlikely that the crop will prove profitable.

It was observed that where the land had been carefully fallowed the crops were very free from take-all, whereas on stubble land or on fallow that was not well cultivated this disease was somewhat prevalent, and in a few cases it caused considerable loss. It is necessary to bear in mind that take-all is a fungus disease which lives on other plants besides wheat. Barley grass is particularly susceptible, and if allowed to grow on fallowed land

carries the disease forward to the next crop of wheat. It is possible for this disease to cause very serious losses, and for this reason alone it is very desirable to cultivate the fallows, particularly in early spring.

A point to which I would like to draw attention is the improvement of the fertility of the soil. Fallowing, the application of fertilisers, and the grazing of stock, particularly sheep, each has a part in this. Crops feed upon certain substances in the soil, principally phosphoric acid, nitrogen, and potash. Every soil contains large quantities of these, but they exist principally in an insoluble form, and must become soluble before they can be used by crops. It is because there is not quite enough available phosphoric acid that superphosphate gives such good results. The process of converting these insoluble substances into a form in which they can be used by crops depends largely upon the supply of moisture and air in the soil, and takes some time.

It follows, therefore, that the longer the soil is kept moist and in such a friable condition that air penetrates freely, the more capable will the soil become of growing good crops. I was particularly struck by the excellent crops grown on land which had been under cultivation for close on half a century. These crops indicate that fallowing, besides conserving moisture, increases the immediate fertility of such land.

Sheep are also of considerable value in improving the soil, and in this connection I would like again to refer to Mr. Lyons' crop grown on land fallowed after having been grazed with sheep for a little more than a year. This was a really wonderful crop, and I think that its extra weight compared with crops grown alongside on fallowed land not grazed, combined with the returns from the sheep, will prove very profitable.

Mr. W. H. Smith, who judged the crops in your competition in 1919, and who is perhaps one of the most successful farmers in Australia, referred to the importance of sheep, and I would like to emphasise his remarks. It is of course, difficult for me to say just what part sheep should take on the farms at Wagga, but it is a matter to which I would like to see close consideration given by farmers. Just at the present time sheep are not exactly good property, but I feel sure this is only temporary, and that within a short time a considerable improvement will take place. Further, it is not safe to predict what the future will be in regard to wheat prices, and it would seem to be a sound policy for farmers to carry sheep, so that if anything happened to the wheat market they will not be badly hit.

Farmers to whom I have mentioned this have raised the objection that it is difficult to ensure a supply of feed throughout the year for any number of sheep. This is the crux of the matter, and I suggest as a solution that oats be sown very early on portion of the land, to be used as sheep feed. A heavy seeding would produce a large quantity of feed, and, by providing feed in the winter and early summer, would save the grass for later feeding. Mr. Anthony Brunskill and the Manager of Wagga Experiment Farm have

both demonstrated the practicability of making silage in pits, and its value as feed during droughts, and reserves might be made in a similar way by other farmers for periods of severe drought.

The value of fertilisers is thoroughly appreciated by farmers in the Wagga district, but perhaps a little more consideration might be given to the quantities applied. The general practice is to apply from 50 lb. to 60 lb. per acre, but I am inclined to think that on the lighter soils, particularly when well fallowed, this quantity could be appreciably increased. At any rate, it is worthy of note that Messrs. Wilson and Field used 90 lb. and 80 lb. respectively, and in regard to growth their crops were among the finest seen. Many farmers are under the impression that if heavy quantities are applied the crop will burn off, but I think that provided the land is well fallowed this fear is groundless. I would certainly suggest that farmers try heavier dressings on some portion of their land. The most suitable quantity depends upon the nature of the soil, and as this varies on different farms, and even on a single farm, it is a matter which, like many others, can be determined only by the farmers concerned.

A feature with which I was particularly struck was the importance of the selection of the variety most suited to the local conditions. Generally it is apparent that close attention had been given to this, but nevertheless it was observed that some unsuitable varieties were being grown on fairly large areas, and that as a consequence the farmer concerned would suffer comparatively heavy losses. The selection of a variety depends upon the nature of the soil, the time of sowing, and the purpose for which the crop is to be used. In the Wagga district it would appear that dual-purpose wheats—*i.e.*, varieties suited for grain or hay—are the most suitable, unless a farmer has definitely decided, when sowing, that he will convert his crop into hay. On the other hand, if he is far from the rail, hay is unprofitable, and heavy grain yielders such as Federation should be selected.

Wagga district can be said to be almost absolutely safe when the land is fallowed. This is not the case with most of the State, and it is impossible to say when sowing whether the season will be droughty or otherwise. If the crop fails elsewhere, then the price of chaff rises to a very high level, and if the variety is a good hay sort the crop is very profitable. For this reason it would seem that the best sorts to grow are those which give a good yield of either grain or hay. Such sorts are Yandilla King and College Purple. Many of the best farmers showed large areas of these two sorts. Some fine crops of Turvey and Minister were also seen. The latter seems to be a very suitable variety, particularly for grain. Canberra was seen on some farms; but while this variety is exceptionally valuable in the drier districts of the State, it is doubtful whether it is a good sort for the Wagga district, except when, for any reason, sowing is late. Among hay wheats, Warden is undoubtedly the best. It gives a very heavy yield, stands up exceptionally well, and has a splendid colour, with a fine straw. Firbank is a useful hay variety for sowing to a small extent, as it enables an early start

WAGGA GROWING-CROP COMPETITION.—POINTS AWARDED LEADING COMPETITORS.

Names and Addresses of Competitors.	Area of Crop.	Varieties.	Methods of Cultivation.	When Sown.	Seed per acre.	Superphosphate per acre.	Number of Previous Crops.	Apparent Yield. *	Trueness to Type. †	Freedom from defects and disease. ‡	Evenness. §	Cleanliness. ‖	Cultivation. ¶	Total.
	Ac.				lb.	lb.		Pts.	Pts.	Pts.	Pt	Pt.	Pt.	Pts.
1. T. V. & R. L. Brunskill, Thackwood, Lake Albert.	600	Firbank, Warden, Turvey, Red Straw, Red Lammas, College Purple, Federation, Marshall's No. 3, Oats.	Ploughed July and August; disc cultivated twice and drilled; stubble, ploughed, harrowed, drilled, and harrowed after drill.	April and May	60	56	Old land	25	19	18	18	28	28	136
2. A. A. Wilson, Kyeema, Old Junee.	400	Federation, Bomen, Zealand, Yandilla King, Firbank, Canberra, Oats.	324 acres on fallow; ploughed August; spring-toothed in spring and before drilling; stubble. 76 acres disced twice.	April and May	50, 70	60 to 90	30 years	25	18	18	18	28	28	135
3. T. H. Brunskill, Mona Vale, Ladysmith.	200	Firbank, Canberra, Warden, Farmers' Friend, Oats.	Land under crop 1919, grass 1920; ploughed January-February; spring-toothed and rolled, harrowed and drilled.	April, May, and June.	65	60	20	24	19	17	18	28	28	134
4. (Mrs.) A. Lewington, Uranquinty.	460	Warden, College Purple, Oats.	Fallowed, worked with spring tooth, harrowed.	May ..	60	56	Old land	24	18	18	18	27	28	133
5. E. Hayes, Haywood, Wagga.	400	Yandilla King, Federation, Canberra, Turvey, Bomen, Marshall's No. 3.	Ploughed in June and July; harrowed twice; worked with spring-tooth in October; harrowed November; disced and harrowed before sowing.	April to June	60	56	12 to 14	24	18	18	17	27	28	132
6. E. Field, "Wave Hill," Marrar.	250	Minister, Yandilla King, Federation, Firbank, Canberra, Hard Federation.	151 acres fallow; ploughed June; disced in spring; worked both ways with spring-tooth before sowing; harrowed after sown; balance on oat stubble; disced before sowing; harrowed after sowing.	April and May	56	80	10 to 12	26	17	17	18	27	27	132
7. James Mullins, Malebo.	210	Hard Federation, Turvey, Canberra, Federation.	170 acres fallow; cultivated in autumn; 40 acres sown on stubble.	May to June	50	32	7 and 2	25	19	17	19	25	26	131
8. D. Hamilton, Pine Park, Downside.	265	Federation, Canberra, Yandilla King, Firbank, Warden, Oats.	Fallowed, harrowed, and worked with spring-tooth before harvest; disced twice in autumn.	May ..	50	40	Old land	26	18	16	17	27	27	131

Maximum Number of Points..	*	†	‡	§	‖		¶	
	1 point for every bushel wheat, oats, or barley.	20	20	20	1st crop ..	24	1st crop ..	24
					2nd ,,	25	2nd ,,	25
					3rd ,,	26	3rd ,,	26
					4th ,,	27	4th ,,	27
					5th ,,	28	5th ,,	28
					6th ,,	29	6th ,,	29
					Over 6 crops.	30	Over 6 crops..	30

POINTS AWARDED LEADING COMPETITORS—*continued.*

Names and Addresses of Competitors.	Area of Crop.	Varieties.	Methods of Cultivation	When Sown.	Seed per acre.	Superphosphate per acre.	Number of previous Crops.	Apparent Yield.	Trueness to Type.	Freedom from defects and disease.	Evenness.	Cleanliness.	Cultivation.	Total.
	Ac.				lb.	lb.		* Pts.	† Pts.	‡ Pts.	§ Pt.	‖ Pt.	¶ Pt.	Pt.
9. W. R. Lyons, Sackville, Wagga.	470	Zealand, Warden, College, Purple, Baroota Wonder, Oats.	130 acres stubble ploughed late and sown; balance fallowed; harrowed, then spring-toothed, then harrowed three times; 180 acres of fallow, grazed one year before fallowing.	May	90, 80	50	15–20	25	18	17	18	27	26	131
10. Executors late W. F. Stone, Springwood, Uranquinty.	450	Red Straw, Marshall's No. 3, Purple Straw, Marquis, Warden, Oats.	Ploughed July and August; disced February and March.	April and May	60	45	Old land	25	18	17	17	26	28	131
11. A. A. Koetz, Clarence Vale, Wagga.	225	Zealand, Hard Federation, Yandilla King, Firbank, Canberra, Oats.	160 acres fallow; ploughed June and July; harrowed and worked with spring-tooth November; disced February; cultivated with spring-tooth before sowing; stubble ploughed May.	April, May, and June	45 to 60	50	Old land	22	18	18	18	27	27	130
12. W. J. Hurst, Lansdowne, The Rock.	328	Warden, Yandilla King, College Purple, Canberra, Waratah, Federation, Hard Federation, Oats.	All fallowed; ploughed July; spring-toothed October; disced in March.	April and May	60	45	Old land	25	17	17	18	26	27	130
13. A. H. Goldsworthy, Inglewood, Harefield.	300	Yandilla King, Canberra, Federation, College Purple, Baroota Wonder, Oats.	180 acres fallowed; ploughed July; harrowed in spring; disced in February, and again in May; balance stubble; ploughed and harrowed.	April and May	60	45	10 to 30	23	18	17	18	26	27	129
14. J. Harrison, Clear View Farm, Wagga.	170	Warden, Firbank	Ploughed June and July; cultivated with spring tooth and disc in spring and again in autumn.	May and June	50, 60	60	25	22	18	15	17	27	27	129
15. C. Condon, Jnr., Warrawon, The Rock.	370	Warden, Zealand, Major, Dart's Imperial, Yandilla King, Canberra, Firbank, Federation, Penny, Oats.	250 acres ploughed for fallow September; harrowed 150 acres fallow; cultivated March and April twice; 100 acres stubble disced; 20 acres stubble ploughed and worked with spike roller.	April and May	50	56	3 to 7	25	17	18	18	25	26	129

	*	†	‡	§	‖		¶	
Maximum Number of Points	1 point for every bushel wheat, oats, or barley.	20	20	20	1st crop ..	24	1st crop ..	24
					2nd ,, ..	25	2nd ,, ..	25
					3rd ,, ..	26	3rd ,, ..	26
					4th ,, ..	27	4th ,, ..	27
					5th ,, ..	28	5th ,, ..	28
					6th ,, ..	29	6th ,, ..	29
					Over 6 crops.	30	Over 6 crops..	30

to be made, and gives an opportunity to get men, machinery, and horses into good working trim before the main harvesting commences.

Taken as a whole, the crops inspected were reasonably true to type. In some, however, the presence of strangers was noted. This, of course, was particularly apparent in the case of Federation. This variety is rather short in the straw, and this feature, together with the brown heads, makes plants of any other sort growing with it stand out clearly. It is the striking appearance of the strange plants which causes the general impression that Federation tends to run out. Close inspection of other varieties, however, indicated that, while not apparent on a cursory view, there was an equal proportion of strangers present. I regard purity as of great importance. When two wheats of similar characteristics are growing together no very great harm results; but when the admixture is of an early and a late variety, it is obvious that considerable loss, or at least much inconvenience, may be caused, as harvesting must be delayed until the latest sort is ripe. A mixture of a tall variety with a short variety is also very objectionable.

Many of the best crops were grown from graded seed. Such seed gives strong, healthy plants which grow to an even height. Ungraded seed frequently produces plants of uneven height, leading to trouble in harvesting. Many of the plants produced from small, shrivelled grain are poor yielders, and reduce the general average. Ungraded seed usually contains much cracked grain, which is useless for seed purposes. Grading separates this and makes it available for pig or poultry feed. The saving of this grain alone will, in many cases, pay for the grading.

Fairly heavy seeding is evidently profitable, judging from the crops inspected. In nearly every case the heavy crops were sown at the rate of between 50 and 60 lb., usually the latter, while in a few cases even heavier seeding had given satisfactory results. The rate of seeding depends very largely upon the nature of the soil. On the lighter soil where stooling is not great, heavy seedings should be made. In a few cases it was noted that if another 15 lb. of seed had been sown per acre the yield would have been much heavier.

The wheat crops were reasonably free from diseases. Take-all was the most apparent, and some loose smut was noted. This disease cannot be prevented by treatment of the seed, as the plants are infected about flowering time by wind-borne spores. Some varieties are more resistant than others. Yandilla King and College Purple appear to be amongst the resistant sorts. This disease is, however, not very important, or rather does not cause any appreciable loss. Apparently the seed wheat is carefully treated for bunt (stinking smut). This disease was, however, noted in two crops, and in each it was present in a very large proportion of the heads. This is a very serious disease, and the importance of carefully treating the seed cannot be overstressed. The bluestone treatment is largely used. In many cases a 2 per cent. solution is adopted, but I think this is heavier than is necessary. A $1\frac{1}{2}$ per cent. solution (that is, $1\frac{1}{2}$ lb. to 10 gallons of water) with immersion

lasting three minutes gives very satisfactory results. The formalin treatment (1 lb. to 40 gallons of water) was used by many farmers. Apparently this year it was satisfactory, although one very capable farmer who had used it thought that he would revert to the bluestone method. In seasons when germination occurs immediately the formalin method is satisfactory, but it is likely to lead to deterioration of the seed when germination is delayed.

Rust was observed on the flag in a number of the crops, but this is not likely to cause any damage. Flag smut was noted in a couple of crops to a very serious extent. This causes dwarfing of the plant, and sometimes kills it right out before it reaches the earing stage. Pickling of the seed helps to prevent it, as also does fallowing.

The Wagga District.

Having had the opportunity of seeing practically all parts of the Wagga district during the course of the judging, I might be permitted to state my impressions briefly. A special feature is the evident prosperity of the farmers, which is a sure indication of the productivity of the district. Quite a number who, a very few years ago, started with a very small amount of capital now have very fine farms with comfortable homesteads and substantial outbuildings. In this respect the Wagga district is at least equal, if not superior, to any other district in the State. Practically all the land is fertile and arable. As a rule hilltops cannot be cultivated, but here we noted crops growing luxuriantly right over the crests. This district with its gently curving hills and its many valleys is most attractive. From any of the hills magnificent views of green fields of wheat alternating with red fallows may be obtained.

The fertility of the land is evidenced by the wonderful growth of the crops. Much of the wheat was 6 feet high and very dense, while the oat crops were in some cases over 7 feet high. The soil is of a free loamy nature throughout, is easily worked, and responds remarkably well to fallowing. The fact that during the sixteen years over which you have conducted this competition you have had to abandon it only once owing to drought indicates the safety of the district for wheat growing.

Many of the farmers' homes are set off with pleasant little flower gardens, while a kitchen garden supplies vegetables. Fruits of all kinds appear also to thrive with very little attention. At a number of homes splendid repasts were placed before us, and we were informed that everything, with the exception of tea, sugar, and condiments, had been produced on the farm.

It was noted also that the land is of high grazing value, and it is remarkable how quickly it produces a dense growth of nutritious grasses when allowed to remain out of cultivation. This feature renders the district most suitable for mixed farming, in which sheep have an important part. While wheat growing is the main farming industry, I was much impressed with the potential value of many parts of the district for dairying, and it is somewhat surprising that greater attention is not paid to this.

On the Taroutta Creek and along the Murrumbidgee very extensive flats occur. On the Tarcutta the land is evidently very highly adapted for the growth of lucerne, as some exceedingly fine crops are grown there. Other crops, such as Sudan grass and sorghums, should also do well, and on this class of country dairying should be very profitable.

Along the Murrumbidgee, below Wagga, very large rich alluvial flats occur, which could be irrigated from the river at small expense, and made to produce luxuriant crops of all descriptions. By cultivation and the conservation of fodder in the form of silage, as a reserve against drought, those flats should be very suitable for dairying, and should support a great many more farmers than at present.

In conclusion, I would like to say that I consider you have, in conducting these experiments, done a service of very great value to the farmers and to the community generally. The standard of farming in the Wagga district is higher than in any other district in the State, and this, I am of the opinion, is due very largely to these competitions. Undoubtedly during the past few years a considerable improvement in farming has taken place, and this is probably due to the publicity given to the methods of good farmers.

If I might make a suggestion, I would say that two prizes might be given for the best kept farm--one for farms where over 200 acres are cropped and one where under 200 acres are cropped. It has been suggested to me that a prize might be given for the best fallowed land. While I would like to see such a prize given, I think that it would inconvenience judging if the number of entries were as large as this year, as the fallow is not always close to the crop. The judging of the best kept farm, however, would not cause much delay, as the homestead must always be visited and a considerable portion of the farm is seen when inspecting the crops. In any case the crops themselves are, as a rule, a sure index of the care bestowed upon the fallow.

I would like also to express my appreciation of the excellent arrangements made by your secretary, Mr. White, and of the assistance given by him and Mr. Sullivan to me in carrying out the work.

Summer Schools in Apiculture.

Arrangements have been made by the Department for two summer schools in apiculture to be held this summer to provide training for those already engaged in bee-keeping, or desirous of taking up the industry. One school will be held at Hawkesbury Agricultural College, Richmond, the period of tuition being from 4th to 21st January, and the fee (including tuition, board and lodging) £4. The other school will be held at the Government Apiary, Wauchope, the school commencing on 28th December, and terminating on 7th January, and the fee (covering tuition and conveyance from Wauchope railway station) is five shillings. Students attending the school at Wauchope will be required to provide their own camp and meals. The prospectus of both schools is obtainable on application to the Under Secretary and Director, Department of Agriculture, Sydney.

Farmers' Experiment Plots.

Summer Fodder Trials, 1920–21.

Central Coast.

J. M. PITT, Assistant Inspector of Agriculture.

Fodder trials were carried out during 1920–21 in co-operation with the undermentioned farmers :—

M. Smith, Bona Vista, Paterson.
R. Apps, Miller's Forest, Hunter River.
R. Richardson, Mondrook, Manning River.
V. Murray, Pampoolah, Manning River.
F. Longworth, Ghinni Ghinni, Manning River.
J. C. Duff, Mount George, Manning River.
J. Latimore, Bulliac, Manning River.
W. H. Warhurst, Moonebar, Macleay River.
John Booth, Temagog, Macleay River.
J. G. Ward, Sherwood, Macleay River.
Brown and O'Shea, Gladstone, Macleay River.

The season was remarkable for the abnormally wet summer and autumn months, floods (especially along the Hunter district, where they occurred at intervals from December onward) submerging much of the rich agricultural lands as many as six times with disastrous results, making it impossible, in many instances, to harvest the yields. It may be stated that the rainfall from December till June at many centres exceeded the average yearly total. Only on those plots sown very early or on well-drained and sheltered situations could accurate results be obtained.

The experiments were confined chiefly to sorghum and maize, but a couple of Sudan plots were conducted, though the latter fodder, owing to its susceptibility to leaf blight, and its failure under warm, moist conditions, can hardly be recommended for extensive sowings on the central coast.

Saccaline is now almost universally sown in preference to Planters' Friend. Its outstanding qualities are its heavier yielding capacity, its greater sugar content, the preference shown for it by all classes of stock, and its capacity when sown late in summer (January and February), to retain the succulence of its stalks throughout the winter and early spring, which renders it of immense value at a time when succulent fodder is usually scarce. On the central coast it shows greater resistance to the "red stain" disease than any other variety of sorghum or Sudan grass, whether sown early or late. It may be mentioned that Saccaline, in a few isolated cases, has not lived up to its reputation; but, on investigation, this has invariably been the result of poor seed—a strain of Sudan grass, sorghum, and even of broom millet showing out prominently in the growing crop. Only seed from reliable sources should be sown.

Most of the best Saccaline crops are now obtained with December, January, and even February sowings, maize being used in preference for early summer and midsummer feed for the cows. For milk production "cow corn" has few superiors. It is surprising that so little attention is given to the varieties grown, the majority of farmers planting any old variety—some nondescript seed obtained from a local store. The outstanding qualities of Leaming and Fitzroy have many times been referred to, the former for its fine stalks and cob-producing qualities, and the latter notably for its heavier yielding capacity and sweetish stalks.

A Third Growth of Planter's Friend at Miller's Flat.

Planters' Friend is still sown extensively in the Hunter district and the islands on the Lower Manning, chiefly for late summer and autumn use. In several instances crops have been so badly affected with "red stain" that they have been almost totally unfit for food. Two new varieties of sorghum—Honey and Orange—were tried at Mount George, both being of exceptional quality, and giving an immense amount of fodder.

Cultural Notes.

Paterson.—Sudan sown on loamy river bank soil first week in December; produced fine growth, 5 to 7 feet; fed off by cows; part made into hay; blight noticeable. Saccaline sown broadcast on 12th December; fine, succulent growth, lasting throughout the winter.

Miller's Forest.—Sandy, loamy soil; seed sown in drills 27th November; very good growth; cows showed marked preference for Saccaline over Planter's Friend. In the maize fodder plants, although Red Hogan returned the highest yield, the stalks were coarse and woody. Cocke's Prolific can hardly be recommended for the same reason. Leaming and Fitzroy gave fodder of high quality.

Mondrook.—This was a magnificent crop; sown on 10th October; weighed 30th March; crop averaged 13 feet in height. Although sown on new land, the addition of fertilisers considerably increased the yield.

Pampoolah. Sown thickly in drills on 25th January; seed weevily; fine growth, but too much knocked about by rain and wind to weigh.

A Record Crop of Saccaline at Mondrook.

The yield was 38 tons per acre.

Ghinni Ghinni.—Sown on alluvial soil on 20th December; covered by floods and blown down before reaching 3 feet; not weighed.

Mount George.—The two new varieties of sorghum were sown in drills on rich alluvial soil on 6th November; magnificent growth, 13 feet high; rich and succulent; both promising sorghums; badly lodged and knocked about by incessant wet weather; weights not kept.

Bulliac.—Sudan grass sown broadcast for hay; grew about 5 feet; only one growth; blight present.

Moonebar.—Only a few rows sown as a trial on sandy, loamy soil; growths patchy, owing to uneven nature of the ground.

Temagog.—Sown in November on a rich piece of alluvial deposit; Saccaline returned a very fine crop; the grower regards Saccaline as the best of the sorghum family he has tried. Sudan grass was a failure, becoming blighted.

Sherwood.—Sown on 29th November; until knocked about by wind and storms, this plot promised to be one of the heaviest on the coast; reached 12 feet and had not broken into head; it was impossible to obtain weights later in the season.

Gladstone.—Sown in December; soil rather heavy; suitable for sorghum; crops very fair.

The Results.

The variety trials resulted as follows:—

Saccaline.—Paterson, 17 tons 17 cwt.; Miller's Forest, 30 tons 2 cwt.; Moonebar, 9 tons*; Temagog, 18 tons*; Gladstone, 18 tons.*

Sudan grass.—Paterson, 10 tons; Bulliac, 10 tons.

Sorghum.—Gladstone, 16 tons.

Variety trial with maize at Millers' Forest:—Red Hogan, 26 tons; Fitzroy, 25 tons; Cocke's Prolific, 25 tons; Leaming, 23 tons.

FERTILISER trial at Mondrook with Saccaline:—

	Return in tons.
Superphosphate, 2½ cwt. per acre	38
M5, 210 lb. per care	38
M6, 2 cwt. per acre	33
M7, 182 lb. per acre	30
No manure	27

It was impossible to weigh the crops at Pampoolah, Ghinni Ghinni, Mount George, and Sherwood.

WINTER GRAZING CROPS FOR THE IRRIGATION AREAS.

WINTER fodder and grazing experiments carried out for a number of years at Yanco Experiment Farm have led the Department to conclude that on the soils of the Irrigation Area the most suitable crop for winter feed is a vigorous, early maturing wheat, such as Firbank. In the trials which last season terminated this series, the variety of wheat mentioned was the only one of the crops sown which made a satisfactory showing before spring.

The competing plots (all sown on 15th April with 800 lb. superphosphate per acre) were: Firbank wheat and tick beans (58 lb. wheat and ½ bushel beans); Black Winter rye (60 lb.); Ruakura oats (52 lb.); rye-grass (a mixture of two Italian varieties, 20 lb); and Cape barley and field peas (26 lb. barley and 31 lb. field peas.) The Firbank wheat made such satisfactory growth by 22nd July as to provide a day's grazing for twenty Ayrshire cows in full milk, the animals grazing off the plot so perfectly as to give it the appearance of having been harvested with a reaper and binder. The competing crops only matured when there was a superabundance of natural grazing.—L. J. GREEN, Experimentalist.

* Approximate.

Pastures in our Wheat-growing Districts.

The Displacement of Native Grasses by Introduced Herbage.

[Concluded from page 773.]

E. BREAKWELL, B.A., B.Sc., Agrostologist.

Growth During Drought Periods.

OWING to the fact that nearly all the introduced herbage is of a succulent character, accustomed to the moist conditions of Europe, it fails altogether in this State during a dry winter and spring. In the drought years of 1918 and 1919, Burr trefoil and the introduced crowfoots germinated well with a small amount of rainfall; Barley grass and Cape weed germinated badly. In all cases the plants withered off when a couple of inches high, and great losses in sheep were occasioned in "herbage" country. Pastoralists who had paddocks of Danthonia and Stipa grasses were easily the best off.

The Fodder Value of Introduced Herbage.

The plants possessing the greatest fodder values belong to the orders Leguminosæ, Geraniaceæ, and Gramineæ.

LEGUMINOSÆ.

Burr Trefoil.—This plant probably produces the greatest amount of fodder, but it is not the most nutritive. It makes good hay or ensilage, and is a favourite with pastoralists owing to its abundance of "burrs," which sustain and even fatten the sheep during the summer and autumn. An estimate of the abundance of burrs on the plants during the season 1920 showed approximately 2,000 burrs per square foot. The chemical analysis of this trefoil from Narrabri showed its nutritive value to be 75·13, and its albuminoid ratio 1 : 12·2.

Woolly Trefoil.—This produces much less feed than the ordinary trefoil, the plant adopting usually a rosette habit.

A Burr Trefoil (*Medicago laciniata*).—So far not abundant, but of good fodder value. The chemical analysis of this trefoil from Narrabri showed its nutritive value to be 65·78 and its albuminoid ratio 1 : 8·6. The plant contained 55·28 per cent. of carbohydrates and 6·56 per cent. albuminoids.

Spotted Trefoil.—Not abundant, except in cold districts. The fodder value is equal to the other trefoils.

Ball Clover.—This is probably the most nutritive of all the introduced legumes. Where it grows in abundance, as in the Riverina, it will fatten sheep and cattle quicker than any other plant.

Woolly Clover.—This is not at all abundant, but is nearly as nutritive as Ball clover.

GERANIACEÆ.

Native Crowfoot.—This plant produces an enormous amount of feed, but for a short time only. It grows quicker and dies off sooner than any of the other herbage. During September and October it develops from a seedling to 3 feet or over; in November, particularly after a hot wind or thunderstorm, only dry withered stalks remain. It has wonderful fattening properties for this short period, but, owing to its very succulent character, does not make good silage, if used alone. The chemical analysis of a plant from Narrabri showed its nutritive value to be 77·04, and its albuminoid ratio 1 : 10.

Introduced Crowfoots.—These are much smaller plants than the native crowfoot. ***Erodium cicutarium*** (Alferilla) is the better of the two, and is thought so highly of in America that the seed is a marketable commodity.

Wild Geranium.—A native plant of good fodder value. It is, however, neither very abundant, nor does it grow very tall.

GRAMINEÆ.

Barley Grass.—This grass is almost as short-lived as native crowfoot. It is a good fattening grass in its young stages, but is not appreciated by stock when in flower. The sharp seeds are very troublesome to the mouths and eyes of sheep, and the grass is detested by most pastoralists. It is serviceable for hay or silage, but requires cutting early to avoid the sharp seeds.

Rat's Tail Fescue.—This is the commonest of all our introduced grasses, but is unfortunately a very short-lived and usually harsh annual. Stock do not relish it and, as it sets seed most abundantly, it spreads far and wide, and suppression is most difficult.

Introduced Brome Grasses.—Opinions differ as to the value of these, particularly in the case of ***Bromus maximus*** (Great Brome grass). Some pastoralists consider it a good fattening grass, while others condemn it for having no feeding value. It is regarded as a weed in England and America. Generally speaking, the other Brome grasses, (*B. mollis*, *B. tectorum*, and *B. racemosus*) are thought little of.

Wild Canary Grass.—This is a distinct acquisition to our pastures, and it would be well if it could replace Barley grass. It is most succulent and palatable; it grows tall, and there is no trouble with the seeds, as there is in the case of Barley grass.

Lamarckia aurea.—This is spreading rapidly of late years, but is not a good grass.

Introduced Eragrostis Grasses.—With the exception of *E. major* these grasses have good fodder value in summer. *E. major* (Stink grass), however, is only eaten during its young stages, and, owing to the manner in which it sets its ripe seeds, is spreading rapidly and is becoming a serious nuisance in cultivated crops.

Barnyard and Summer Grass.—These have high fodder values, but are also bad in summer crops.

Herbage with Limited Fodder Value.

Variegated Thistle.—Pastoralists and farmers generally advocate the growing of this thistle. This is difficult to understand. I have been careful in investigating its fodder value, and find that although horses sometimes eat it, the plant is neglected by sheep and cattle. Owing to its succulent character, however, it makes good silage.

Rib Grass.—This is readily eaten by all stock. Its nutritive value is not as high as some of the other herbage, but its medicinal properties render it a good plant in pastures.

Cockspur or Saucy Jack.—This is one of the few thistles with spineless leaves, and it is sometimes advocated as a fodder plant. Its nutritive value, however, is low, and it possesses a bitter taste. Owing to its vigorous character shire councils act wisely in proclaiming it a noxious weed.

Wire Weed.—This is undoubtedly a good fodder plant in spring and summer, and chemical analysis shows a high protein and carbohydrate content. The amount of fibre is, however, very large. Occurring frequently in cultivated and stubble land it is a fairly simple matter to keep the weed down by stocking heavily with sheep.

Wild Melon.—This grows prolifically in the summer months in the wheat-growing districts, and is very drought-resistant. It is readily eaten by sheep, and could be kept under in a similar manner to wire weed.

Supposed Fodder Plants that Require Suppression.

Cape weed and cockspur thistle have a big hold throughout the State, and pastoralists often claim that they are good feed for sheep. This only holds, however, in dry seasons, as when other feed is available they are not usually eaten. Considering the manner in which these plants often crowd out good vegetation it would be far preferable to grow summer crops such as Sudan grass, sorghums, &c., than to rely on these plants for feed.

Paterson's curse (*Echium plantagineum*) is now well established in the Riverina, South-western Slopes, and Central-western Slopes. Indeed, suppression has now become a difficult matter. For this reason shire councils are at variance with the landholders, who strongly maintain that it is a fodder plant. As soon as such a weed as this obtains a strong hold and sheep begin to eat it, the plant has advocates for its existence, and, as a consequence, instead of good grass and herbage pastures we have large areas of country overrun with plants belonging to botanical orders which have never yet revealed any great fodder value. It is even on record that a farmer was seeking seed of this plant to sow in his pastures, just as if the seed of good grasses and herbage were not obtainable.

Introduced Herbage *versus* Native Grasses.

In good seasons, if all the growth of herbage could be utilised, much more feed would be available for stock than under the old conditions, when native pastures and herbs grew on the flats and loose soil generally. During the

spring of 1920 an average of at least 10 tons of greenstuff per acre could be obtained anywhere in the wheat-growing districts. For two months of the year (September and October) fifty sheep per acre could be carried without making any impression. There has never been any native grass, nor is there likely to be, that will produce such an enormous amount of feed. No native pastures yet have been known to carry more than two sheep per acre, and one sheep per acre right throughout the year is considered good. But the life of the herbage is very short, and after October it soon withers and leaves the ground extremely bare, except for the burrs in the trefoil country. It follows, therefore, that if the grazing of the herbage

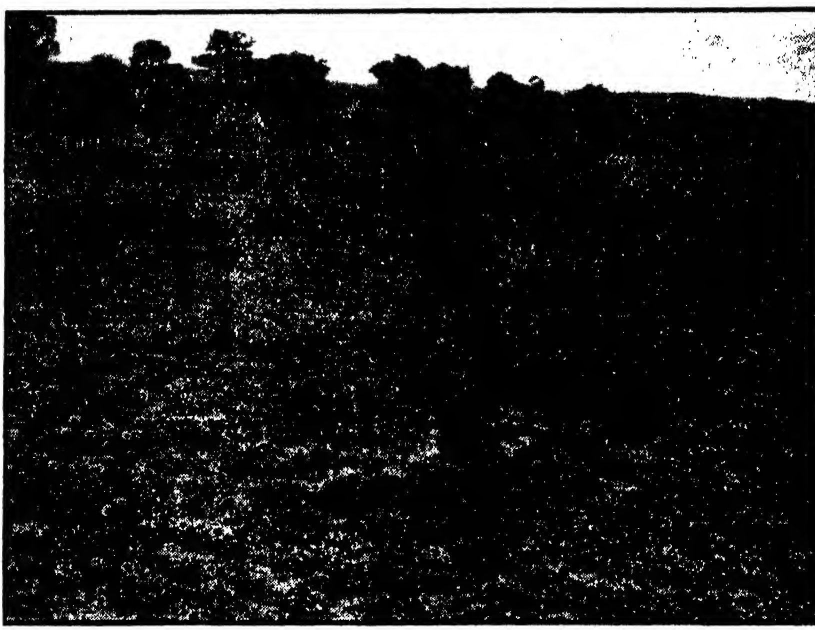


Fig. 5.—Cape Weed in possession in the Wagga District.

alone is relied on, the pastoralist is worse off than if it carried native pastures, which persist throughout the year. Most good pastoralists realise this. I have been particularly careful in obtaining the opinions of old pastoralists who have seen the country conditions for the past fifty years. Most of them maintain that the country does not carry as it used to, and that the old grass country could carry sheep much better throughout the year. The blacksoil plains, with their waving fields of Andropogons, Astreblas and Panicums were much more desirable in summer months sixty and seventy years ago than they are now. Most pastoralists stoutly aver that the herbage country fattens quicker than the grass country, and is particularly valuable at the lambing periods of the year.

In drought periods the native grass country scores easily. As already pointed out, the herbage will not respond unless supplied with a good rainfall, whereas the Danthonias and Stipas will stand an extraordinary amount of dry weather. For example, in Dubbo district at the breaking of the two years' drought in June, 1920, investigation of the Danthonia pastures on the hillsides showed that tussocks, to all appearances dead before the rain, revived in a wonderful manner, and out of forty clumps in three square yards fully 50 per cent. retained their vitality.

The Danthonia pastures in the Riverina district during the drought were the main source of feed, and sheep running on these paddocks were among the small number not sent for agistment to more favoured localities. At Wagga Experiment Farm the sheep running in the Danthonia paddocks

Fig. 6—Native Crowfoot in the Western Districts.

kept in better condition during the spring of 1919 than any other sheep in the district. In fact, the Danthonias and the Stipas provided feed right throughout the wheat districts, where the crops and introduced herbage absolutely failed.

Conservation of Herbage still Neglected.

It follows, therefore, that unless the large amount of herbage which grows in an ordinary season is conserved and not allowed to run to waste, the pastoralist who owns herbage country alone is at a disadvantage compared with the farmer who has native grass pastures; through, as previously pointed out, if the excess of growth of herbage could be conserved, the amount of feed thus produced would probably be much greater than from native pastures. Yet very few wheat farmers conserve such fodder, the causes of failure to do so being (1) want of labour and machinery, and (2) a disinclination to provide for the future, when plenty of feed exists. The first is a

legitimate objection, for it being necessary to cut the herbage quickly when it is at its best, the labour must be readily available. If the cutting is delayed or protracted, the vegetation loses its nutriment, and becomes unsuitable, either for hay or silage. Such labour is required only for a short period, a fact that makes it the more difficult to obtain. The unwillingness of unskilled labourers to leave the larger cities and go to the country renders the conservation of such fodder still more difficult. The problem thus has a relation to the whole question of migration of labourers to urban districts, and thus incidentally to the improvement of rural conditions with a view to the attraction and retention in country districts of such labourers, and the possibility of co-operation of different agricultural bodies in the distribution of labour.

Regarding machinery, very few wheat farmers, except those who grow lucerne, possess mowers or rakes, necessary for cutting the herbage, despite the fact that it would certainly pay to have such implements on herbage country.

Concerning the second cause of failure to conserve surplus herbage—many pastoralists, in a bad season when they are short of feed, affirm loudly that they will not be caught again, but will take care to conserve the fodder when a good season arrives. Yet the lessons of the last drought seem already to have been forgotten, and conservation of fodder was neglected last season even in those localities where labour and machinery were available.

Excess herbage can be conserved either in the form of hay or pit silage. The latter method is recommended as the most economical and practicable one, and most of the herbage is particularly adapted for this mode of treatment. Yet the number of farmers taking advantage of this method in good seasons is ridiculously small, and thousands of tons of good feed are going to waste every year.

A much increased carrying capacity of sheep would be possible in the wheat-growing districts if the right methods were adopted. Mr. Matthews, lately Sheep and Wool Expert of the Department of Agriculture, has undoubtedly proved that the crossbred sheep is the most profitable in such districts. The short grasses and cereal crops are more adapted for grazing sheep than large stock. A limited number of large stock can, however, be maintained on such crops as lucerne, Sudan grass, and introduced herbage. The method adopted in grazing sheep on mixed farms is usually as follows:—Early winter: feed off wheat, oat or barley crop. Late winter: herbage, native grasses, and rape. Spring: herbage, native grasses and rape. Summer: stubble, dried herbage, summer weeds and grasses. Autumn: stubble, dried herbage, summer weeds and grasses. In a good season this method is usually effective, and over a sheep per acre can be carried right throughout the year. In a dry year, however, the crops and herbage fail, and hand-feeding or agistment has to be resorted to.

Improvement of Carrying Capacity.

In order to improve the carrying capacity of our wheat-growing districts the following practices should be adopted :—

1. Conservation of fodder.
2. Employment of rotation crops.
3. Establishment of grass paddocks.
4. Establishment of lucerne paddocks wherever possible.
5. Growing of summer fodder crops.

Conservation of Fodder.—This matter has already been dealt with in connection with the surplus growth of herbage. In a good season, however, cereals could also be grown for hay or silage, and barley has already been proved to make excellent silage. Where lucerne is grown, the value of this crop for hay is of course well known, and a stack of lucerne hay has been claimed by many to be one of the best insurances against drought. Sudan grass also makes excellent hay.

Employment of Rotation Crops.—The practice of rotation of crops is now well established among good farmers. It has been definitely proved that continuous cropping with wheat does not produce the best yields, and also induces the growth of weedy herbage. Many farmers adopt the fallow alternately with the wheat crop, but this practice, while excellent up to a point, is likely to exhaust the humus in the soil if carried too far. As a result of departmental experiments it has been proved that it is preferable (1) to alternate a fodder crop like rape occasionally to provide humus, or (2) to allow the cultivated paddock to run to grass. The herbage of cultivated paddocks that have been allowed to run to grass generally includes a good deal of trefoil, and this, being a leguminous plant, enriches the soil with nitrogen as well as provides it with humus; but if the farmer studies the habitats of the different kinds of herbage shown in the preceding pages, and sows the seed of the legume roughly over the surface, he will be able to establish trefoil herbage in his cultivation paddock much more quickly. For example, Ball clover, which does so well in the Riverina, is a purchasable seed, and could be bought and scattered at a small cost, and similarly Burr trefoil in the Central-western and North-western Slopes. For the cold districts it would be preferable to sow English trefoil (*Medicago lupulina*) rather than the ordinary trefoils.

The value of lucerne as a rotation crop has not been fully recognised. On a mixed farm, lucerne, the king of fodderplants, would be just as valuable an asset as wheat for a couple of years. If it is suited to the district, therefore, there is no better method of renovating partly worn-out wheat paddocks than the sowing of this crop and leaving it for a couple of years. No other plant sends its roots down as deep as this, and the increase in yield of any crop after lucerne has been strikingly proved at Yanco and other places. Where lucerne is not adapted, there are great possibilities for Bokhara or Sweet clover as a rotation crop, and further experiments in connection with this plant are now in process of being carried out by the Department.

Establishment of Grass Paddocks.—"Every holding on which sheep are kept should include an area of natural pasture, either to be reserved as a standby, or to provide a change in feed," wrote Mr. J. W. Matthews, in Farmers' Bulletin, No. 53, New South Wales Department of Agriculture.

As previously pointed out, such pastures, in the shape of the Danthonia and Stipa grasses, are available in many of the wheat-growing districts, but wheat farmers possessing fairly flat country have little or no grass in the late summer and autumn. In such localities the laying down of vigorous grasses is essential. Fortunately, two or three grasses have come to light in the past three or four years, which promise to fill a long-felt gap in wheat-growing districts (see Farmers' Bulletin No. 126, "Sudan Grass," New South Wales Department of Agriculture), and no farmer carrying sheep should fail to have one or more paddocks of Sudan grass in the summer months. A mixture of Rhodes grass, Sudan grass, and lucerne has been found to produce good results as a permanent pasture.

Owing to the difficulty experienced in establishing native pastures by sowing the seed, it is at present preferable to sow a mixture of this kind. Native grasses which are most promising for pastures in wheat districts are a mixture of *Panicum flavidum*, *Panicum prolutum*, and *Danthonia semi-annularis*.

Establishment of Lucerne Paddocks.—The possibilities of lucerne as a fodder crop in the west are just beginning to be realised, and newly established paddocks of this plant can now be seen in localities which ten years ago were considered absolutely unsuitable. For example, at Binnaway, Merrygoen, and even on clay soil at Coonabarabran, very fine results have been obtained. In some cases the lucerne was eaten down so closely during the drought that it was thought incapable of recovery. Yet with the June rains of 1920 it revived wonderfully and now appears as thick as ever. The following localities in the wheat-growing districts have been proved to be suitable for lucerne: Wagga (near river), Coolah, Canowindra, Cowra, Young, Grenfell, Mudgee, Dunedoo to Coonabarabran, Orange, Molong, Inverell, Glen Innes, Tamworth and Wellington. There appears no reason why this area should not be considerably extended to include, say, the North-western Slopes, Dubbo, and even Narromine, Cootamundra, Yass, or any locality where the annual rainfall is 20 inches or over.

Growth of Summer Fodder Crops.—Very few mixed farmers concern themselves with the growth of summer fodders, owing probably either to the apparent clashing of their periods of sowing with the harvesting of the wheat, or to disinclination to attempt to improve the carrying capacity of the land: to these reasons must be added, perhaps, ignorance of the most suitable summer fodders to grow.

It has been proved that the growing of grain sorghums, Amber Cane, sorghum, and Sudan grass is a distinct success in ordinary seasons in wheat-growing districts. These are drought-resistant plants that can be utilised

in three ways—either for silage, rough hay, or for grain; in all cases the aftermath of feed usually carries them well into the winter. During the autumn drought of 1920 no less than two sheep per acre were carried on Milo, Feterita, and Kaoliang sorghums at Cowra for a considerable period, while the Sudan grass paddocks were a veritable paradise for the dairy stock. Farmers who have grown these crops are enthusiastic concerning their virtues, and it is anticipated that in course of time, as settlement becomes closer and more labour and machinery become available, considerable areas will be grown by the mixed farmer. The more one studies the wonderful growth of feed that can be produced in the wheat-growing districts of this State during an ordinary year, the more one realises that nature has compensated the farmer for the loss of native grasses. It remains, however, for farmers to take full advantage of this lavish compensation and to adopt the principles outlined in the foregoing. If they do so a considerable increase in stock and wheat production must inevitably ensue.

Is the Seed-buyer Entitled to Protection?

In the *Agricultural Gazette* for September, a number of instances of poor commercial seed purchased and tested during 1921 were quoted as illustrating the need for legislation to control the sale of seeds. The following is an additional list. In all cases the seeds were obtained by purchase from seedsmen or storekeepers during the past six months:—

Seed.	Fair Average Germination expected.	Germination obtained.
	per cent.	per cent.
Beet—turnip rooted	150*	107
Cabbage—Mammoth Cattle... ...	90	80
Drumhead Savoy... ...	90	70
Do	90	65
Early Drumhead... ..	90	79
Carrot—Manchester Table	70	62
Cauliflower—Late Metropole ...	80	60
Celery—Solid White	90	45
Cowpea—Black	90	65
Lettuce—New York	90	64
Onion—Brown Spanish	85	54
Silver King	85	72
Pumpkin—Japanese	90	45
Radish—Long Scarlet	95	73
Swede Turnip—Champion Purple Top	85	76
Imperial Purple Top	85	72
Turnip—Early Snowball	90	71
Nepaul	90	60
Vegetable Marrow—Long Green Bush	95	65

* From seed balls.

—Wm. Carne, Lecturer in Botany, Hawkesbury Agricultural College.

Seasons of Varieties of Cereals.

Observations at Cowra Experiment Farm.

C. McCAULEY, Experimentalist.

From time to time inquiries are received as to the seasons of newly-introduced varieties of wheat and of departmental crossbreds. The table below has been compiled from observations of different wheats and oats under trial at Cowra Experiment Farm during the past season. It gives this information with regard to the newer varieties, and a number of standard varieties are also included for comparison.

In deciding the season of small grain cereals, it has been found advisable to compare the dates at which the ears appear from the sheath (the "ears peeping date"). This is because in some years maturity is unduly hastened after that stage. For example, although in a season mild at ripening time there may be ten days between the dates of "ears peeping" and then ten days between the dates of ripening of two wheats, yet in another year there will be about the same period between dates of "ears peeping," but a spell of hot weather may result in the two wheats ripening at about the same time. Obviously what takes place is that the later maturing wheat is prematurely ripened.

These figures apply to the Central-western Slopes and similar districts, but would vary in other localities according to the length of the growing season, while they will also vary slightly from year to year in the Cowra district.

Hard Federation is taken as the standard wheat sown in April with the late maturing, and in May with the early maturing varieties.

Among the oats some of the varieties have only recently been named, but the numbers under which they were formerly known are shown in each case. Lachlan is taken as the standard variety in the oats, all being sown in May.

The lists of both oats and wheat are not by any means complete, but the principal varieties grown in the Cowra district have been included. Information regarding the behaviour of these varieties in other respects has been published in various reports and in other articles that have appeared in the *Agricultural Gazette*.

Seasons of Varieties of Oats compared with Lachlan at "ears peeping date."

Variety.	Early.	Variety.	Early.
Mulga (Cowra No. 25) ...	17 days.	Lachlan	9 days.
Sunrise	17 ,,	Wilga (Bathurst No. 11) ...	6 ,,
Quandong (Cowra No. 22) ...	16 ,,	Guyra	6 ,,
Myall (Cowra No. 27) ...	15 ,,	Yarran (Bathurst No. 5) ..	2 ,,
Ruakura	9 ,,		

SEASONS of Varieties of Wheat compared with Hard Federation at "ears peeping date."

Variety.	April Sowing. Earlier.	April Sowing. Later.	May Sowing. Earlier.	May Sowing. Later.
Currawa	....	17 days.	....	....
Warden	....	21 ,,	....	....
Warren	....	15 ,,	....	....
Bomen	....	17 ,,	....	....
Zealand	....	21 ,,	....	....
Marshall's No. 3 ...	....	19 ,,	....	....
Yandilla King ...	....	17 ,,	....	....
Cowra No. 20 ...	....	13 ,,	....	....
Clarendon	....	....	10 days.	....
Canberra	....	....	7 ,,	....
Wagga No. 47 ...	....	....	1 ,,	....
Cowra No. 19 ...	....	....	6 ,,	....
Gresley	....	....	5 ,,	....
Firbank	....	....	11 ,,	....
Billy Hughes... ...	....	....	1 day.	....
Red Wings	....	....	1 ,,	....
Wilfred	....	....	....	3 days.
Bunyip	....	....	8 days.	....
Sands	....	....	1 day.	....
Ecksteen	....	....	....	1 day.
Kultz	....	23 days.	....	....
Kharkov	....	29 ,,	....	....
Kaured	....	29 ,,	....	....
Red Rock	....	27 ,,	....	....
Marquis	....	27 ,,	....	....
Federation	....	....	....	7 days.
Penny	7 days.	....	....	....

CLASSIFICATION OF WHEAT VARIETIES.

THE following classification of varieties of wheat in regard to milling qualities has been adopted by the Royal Agricultural Society for its 1922 show, and is published for the convenience of farmers and of other societies of the kind :—

Macaroni wheats.—Medeah, Indian Runner, Huguenot, Velvet Don, Farrer's Durum, Cretan, Kubanka, Belotourka.

Strong flour red wheats.—Cedar, Red Bobs, Kitchener, Ruby, Snowy River, Marquis, Fife wheats, Prelude.

Strong white wheats.—Comeback, Bobs.

Medium strong flour wheats.—Yandilla King, Gresley, Bunyip, Cleveland, Rymer, Canberra, Bomen, Firbank, Sunset, Thew, Improved Steinwedel, Clarendon, Roseworthy, Warren.

Weak flour wheats.—Currawa, Dart's Imperial, Warden, Jade, King's Early, Petatz' Surprise, Marshall's No. 3, Purple Straw, Joffre, Farmer's Friend, King's White, Major.

Special Classes.—Three wheats have been placed each in a special class of its own, so that none will be allowed to compete except in such special classes and in collections, viz., Federation, Hard Federation, and Florence.—F. B. GUTHRIE.

Improving the Maize Yield.

What the Department is doing for the Farmer.

[Concluded from page 766.]

H. WENHOLZ, B.Sc. (Agr.), Inspector of Agriculture.

Cultivation Experiments.

The increased yields to be obtained by better methods of seed-bed preparation, planting and after-cultivation, have led to the commencement of experiments, chiefly at Grafton and Hawkesbury Agricultural College, to demonstrate how much better yields are possible by cultivating the maize crop more intensively and more intelligently. Methods of cultivation are followed by farmers which in many cases have no other reason for their use than long custom. These methods must be tested against more up-to-date ones, based on scientific reasons, to discover whether many cultural practices perpetuated from past generations (under somewhat different conditions) can still be defended on their results.

At Grafton Experiment Farm, experiments to determine the difference between autumn or winter ploughing and spring ploughing are showing greatly in favour of the former. Tests are also being made here for deep *versus* shallow cultivation of the growing crop, hilling *versus* flat cultivation, early "laying by" or last cultivation *versus* cultivation up till tasselling stage, and to determine the profitableness or otherwise of removing the suckers from the growing crop.

At Hawkesbury Agricultural College, a number of different methods in common use by farmers in fitting the seed-bed in spring, after autumn ploughing, are being tested to discover the best. The methods of planting (surface and furrow or lister sowing) are also the subject of experiment here to determine the difference in case of after-cultivation, and finally the yield.

Rate of seeding experiments (with four different rates) are also in progress at Hawkesbury Agricultural College, and Grafton, Glen Innes, and Bathurst Experiment Farms. These experiments, after several years, may be expected not only to give data on the best average rate for the conditions in the district for the variety used, but they may be applied to any variety in any district when the yield per acre and the average size of ear of the variety are taken into consideration.

At Bathurst Experiment Farm the sowing of maize in much wider drills than usual is being tested against the ordinary method. It is possible that this may be the means of overcoming the difficulty in maize-growing in these drier districts in a dry season.

Experiments with Fertilisers.

For some years now it has been evident that fertilisers are going to play a large part in increasing the maize yields of the State. Even on the alluvial soils of the coast, where 80 to 100 bushels of maize have been grown, fertilisers have made increases of 10 bushels or more. In only a few instances on very fertile soils where the average yields exceed 100 bushels per acre have there been no increases from fertilisers. Such land is now rare, and except where these soils become periodically enriched by the silt of flood waters, fertilisers can generally be relied on to be a profitable investment for maize.

Much of the profitableness, however, depends on the kind of fertiliser or mixture applied. Easily soluble nitrogenous fertilisers, such as nitrate of soda and sulphate of ammonia, have given poor results on the coast, while in the colder tableland districts they appear to be profitable. On the coast, therefore, most of the experiments now in progress consist of mixtures of the two main fertilising ingredients—phosphates and potash.

Since the conclusion of the war a new form of potash (muriate) has been on the market, and experiments have been devised for Hawkesbury Agricultural College and Grafton Experiment Farm, including this potash not only in different amounts, but also in different proportions with superphosphate.

At Grafton Experiment Farm the influence of green manures on the availability of superphosphate and other mixtures is being investigated by field experiments, and the residual effect of superphosphate (if any) on a permanent site compared with the continuous applications which are held by some farmers to have an injurious effect on the soil.

The residual effect of a top-dressing of lucerne on the subsequent maize crop is being tested at Hawkesbury College River Farm, where there is also in progress an experiment to determine the value of deep sowing of the fertiliser in the drill in comparison with sowing at the ordinary depth.

At Yanco Experiment Farm a test of different fertiliser mixtures for fodder maize is being made.

Fertiliser trials with different mixtures and in different amounts have been conducted on farmers' experiment plots for many years, and, as the result of these, definite advice can be given any maize-grower in the State regarding the best amount and kind of fertiliser to use.

The fertiliser requirements for maize have been found to vary widely in kind and amount in the different districts, and also to be different again for a fodder crop and for a grain crop.

Remarkable success has attended the use on the coast of one mixture known departmentally as P7. This mixture consists of equal parts of bonedust and superphosphate, and is applied at sowing at the rate of about 2 cwt. per acre. An average increase of 9 bushels per acre on the coast has been obtained from an average of nearly fifty tests with this fertiliser mixture.

This same mixture is totally inefficient on the Northern Tablelands, where only ½ cwt. superphosphate has given the most profitable increases in yield, as well as having the desirable effect of hastening the maturity of the crop.

Improvement by Breeding and Selection.

There is little doubt that the ordinary method of selecting seed maize in use by most farmers (that is, in the barn at husking time) has little to recommend it for improving the yield of the crop. In an impure variety perhaps the rigid selection of a uniform type may be expected to effect some improvement, but the selection of seed maize in the field is more satisfactory, and this method is at all times advised by the Department. The results obtained by demonstrating this method on the farmer's own crop are so much in advance of the system in general use that every effort is made to give field demonstrations, which are much more convincing than any platform lectures.

The advantages of selecting seed maize in the field, such as maximum production of grain with economy of stalk growth, the elimination of large ears which are due to abnormally good conditions and which have no tendency to reproduce their kind under normal conditions, and the perpetuation of desirable characters of stalk growth, such an absence of weakness, favourable height of ear with sufficient declination at maturity to turn rain, husk covering that is insect or weevil proof, &c., are so apparent that it is not surprising that they influence yields so readily. Up to 7 bushels per acre increase has been made from field-selected seed maize above that selected in the barn.

In addition to the urgency of recognition of this simple means of increasing maize yields, investigations have been started to determine whether many of the characters which are regarded by farmers as being of much importance in selecting seed ears, such as well-filled tips, small cores and deep grain, and straight regular rows, deserve the attention which has been bestowed on them. From these investigations it appears certain that many of these fancy points have been given too great emphasis, and that they do not represent any certain means of maintaining or increasing the yield of maize by selection.

These facts are being discovered by means of the ear-row test, which is simply a test of the yielding capacity under identical field conditions of each selected ear of maize. This work is proceeding at Hawkesbury Agricultural College and at Grafton and Glen Innes Experiment Farms, and differences in yield between the various ears subjected to this test are turned to account in a definite system of breeding for improving the yield and quality of the variety. This work lays the foundation for an improved stock seed, called stud seed, which is raised each year on these farms, and which is available for distribution to farmers. Tests with seed bred by this system have resulted in increases up to 17 bushels per acre in the maize crop, when compared with seed of the same variety, selected in the ordinary way.

Every assistance is given farmers who desire to undertake this method of increasing the yields of their own varieties, and as the result of propaganda work and demonstration on the most desirable system of breeding to suit their conditions, some farmers are actively engaged in pursuing some such system of breeding maize with considerable success.

In other cases, crosses between different varieties of maize have been made on some of the experiment farms and with reliable farmers, to discover the increased yield, if any, of the first generation crossbred seed, and to endeavour to find from such a cross a type of maize which will be more suited to certain conditions, neither of the parent varieties possessing all such necessary characters and each lacking some desirable character possessed by the other.

At Yanco Experiment Farm an endeavour is being made to evolve a new variety with some measure of drought-resistance in the pollen, by crossing Silvermine with Chinese Waxy, a variety which has this resistance, but which does not yield well. Many years must elapse before any indication of success with this venture can be given.

No remarkable success has been attained with first generation crossbred seed of two varieties, and the evolution of new types or varieties of sufficient purity will not be achieved for some time yet, though some are making for greater progress than was at first anticipated.

Investigation of other Problems.

In addition to the investigations previously referred to concerning the correlations of visible ear characters with yield by means of the ear-row test, many other characters are being studied in the same relation. These are chiefly weight, length, and shape of ear, roughness of dent, width of furrows between rows of grain on the ear, thickness, and depth of grain, size of core, percentage of grain, hardness of grain, and size of germ.

A study is also being made as to the correlation between certain field characters of the maize plant and the yielding capacity of the seed from such plants with a view to determining, if possible, the type of plant to favour in selecting seed maize in the field. In this connection, the characters which are being investigated are height and thickness of stalk, number of ears per stalk, comparative height, and inclination of ear and length of shank.

This work requires to be extended on the experiment farms, and it is also desired to obtain similar data for other maize-growing centres where no experiment farm is located, but no further extension can be made with it until more assistance is available.

The problem of storage of maize on the North Coast, where damage by weevil is very serious, is being investigated with very promising results There is little doubt that the great losses due to weevil and grain moth can be overcome by treatment with fumigant gas, and the relative merits of carbon bisulphide and carbon dioxide are being studied. Other substances are being tried as repellants and deterrents for weevils in seed maize, and highly gratifying results have been obtained with napthalene. Only lack of funds now delays definite evidence that maize can be stored in bulk successfully on the North Coast. The actual demonstration of this fact will do much to advance the maize-growing and manufacturing industry there: at present it is being largely held back because of the fear of unsafe storage

Leaf blight (*Helminthosporium*) is a common diease with late-sown maize on the coast, and it is annually responsible for a great reduction of yield. Investigations have shown that it is difficult to deal with by the plant pathologist with any hope of success, but fortunately it has been found in the field that there is a marked difference between varieties of maize in their resistance to the disease. Recommendations have therefore been made by the Department for the best varieties for late sowing in different districts, and investigations will be carried on to determine the susceptibility of other varieties to the disease. A start will then be made to determine the possibility of still further increasing the resistance of the variety by selection.

The American maize smut (*Ustilago*) has made its appearance on two occasions, but by prompt suppression it has been entirely stamped out, and not a single case of this smut is now anywhere in the State. The European maize smut (*Sorosporium*) is common on many parts of the coast, and more research is necessary to give practical means for its eradication or subjection. Unlike other smuts, seed treatment is of no use, and the only practical advice which can be given is rotation of crops.

Another disease of growing importance is that caused by minor *Fusarium* organisms, which lead to decay of the roots, stalks, and cobs. Though not extensive, this trouble is increasing, and a sharp look-out is being kept for its possible sudden extension and field methods of combating it are already being investigated.

The European corn borer is a serious pest of maize and other crops in Europe, and was recently introduced into America with imported broom millet from Italy. This importation into America has now been entirely prohibited and the attention of the Federal Quarantine Department has been drawn to the danger of its introduction here.

A strict watch is also being kept on the cattle grazing on cornstalks, especially in a wet winter on the coast and tablelands, to observe whether the so-called "cornstalk disease" of cattle which is prevalent in America is of any concern here.

Australia is very much behind America in the utilisation of maize grain for human and for stock food. A surplus production, which is inevitable now and again, would present no terrors for the farmer who depends on an outside market for his maize crop if he were to realise the eminent uses for stock to which maize can be profitably put. Feeding experiments are badly needed in this State—perhaps with maize more than any other crop. Practically no experimental work has yet been done here, and American tests are, in most cases, of little use, owing to the different conditions and different feeding stuffs which are available to supplement maize.

It is proposed to institute some experiments shortly on the feeding of maize grain to dairy cows—a practice which is already followed by some farmers with unqualified success. Figures showing the increased yields and profit from such a practice provide data which is urgently required for propaganda work by the Department among farmers.

Propaganda Work, Instruction, and Advice.

From time to time articles on different phases of maize-growing, such as selection of seed, preparation and cultivation of the soil, methods of improving the soil by use of rotation crops, green manures, and fertilisers, are published in the *Agricultural Gazette,* and shorter articles are also prepared for use in the weekly notes which are issued to the country press. Topical questions for certain districts are also dealt with in the course of travelling through the State, and information for the guidance and benefit of farmers is often published in country newspapers.

The results of the experiments with maize which are conducted on the experiment farms, and also of experiments on farmers' plots, are also published in good time so as to be of use to farmers in planning their next season's work with the maize crop. In some cases the results are only given tentatively as a guide to the progress of the experiment, for a satisfactory conclusion cannot be reached from some experiments until the average of several years' results have been obtained.

In addition to this, notes on the progress and methods of breeding maize which are in use on the experiment farms are given for the benefit of advanced maize-growers who are devoting some attention to breeding work with their own variety.

The results obtained in the ear-row method of breeding maize on the experiment farms are so marked that it is urgently felt that more demonstration to farmers on this method would be the means of rapidly increasing yields, but as this work is being done single-handed at present no further extension with it can be made.

Lectures on any subject connected with maize-growing are given on request to bodies such as branches of the Agricultural Bureau, agricultural societies, branches of the Primary Producers' Union and Farmers and Settlers' Association, and to progress associations in country districts. For convenience in dealing with such a large subject, these lectures are usually given separately on three main phases of maize-growing, viz., soil improvement, selection of seed, and cultivation methods.

In addition to these lectures field demonstrations are also given where desired on such a subject as selection of seed, which can be illustrated more fully and in a practical manner with a farmer's own crop.

On some occasions assistance with the judging of maize exhibits at agricultural shows is given, and suggestions made for more suitable schedules and classes in this crop. In many cases existing and new varieties of maize which yield well in a district have been suggested for inclusion as separate classes in the show schedule, and, besides being of educational value in the identification of varieties, this innovation has been the means of having the best varieties more widely known and grown in the district.

The schedule for maize at the Royal Agricultural Society's Show has been adopted at the suggestion of the Department. It divides the exhibition of maize into two sections, one of which is judged for the seed value of the

ears and the other for the market value of the grain. Classes have now been instituted in the seed ear section for the principal varieties growing in the State.

Advice is also given to farmers by letter on any phase of maize-growing, conservation of silage, and harvesting or utilisation of the crop. A large number of such inquiries are answered weekly, including the naming of varieties of maize sent in by farmers for identification.

At Glen Innes Experiment Farm a valuable method of harvesting maize so as to make the best use of both grain and fodder has been tried. A machine which shreds the cured fodder into a stack for winter feed and which threshes the grain at the same time is in use there, and demonstrations are given at any time during the season.

A new and very efficient method of making stack silage with maize has also been devised, which is suitable for coastal conditions, and which saves the considerable cost of permanent overhead silos and the necessary cutting and elevating machinery and engine. Wherever possible, demonstrations on this new method of putting up stack silage are arranged on request.

The results of this propaganda and instructional work are evident in many districts in better methods and higher yields of maize, and many tributes to the excellence of the work done and the value of the advice given have been received by the Department from farmers during the last few years, in which the activity of the Department with this crop has been markedly increased.

Field Experiments with Maize.

Experiments to ascertain the most profitable quantity of maize to sow per acre were conducted at Hawkesbury Agricultural College last season, the sowing taking place on 17th October and harvesting on 24th May. The results, presented in percentages, were as follows :—

Two grains every 40 inches	(6·1 lb. seed per acre)	 100
„ „ 32 „	(8·4 lb. „)	... ... 110·8
„ „ 28 „	(9·7 lb. „)	... ... 101·8
„ „ 20 „	(12·3 lb. „)	... ... 151·9

Expressed commercially, the heaviest sowing gave a profit of £3 16s. per acre over the lightest one.

The cobs were subsequently graded and compared to determine the amount of marketable grain from each plot, and also the suitability of the grain for seed purposes. The heavy sowing had a distinct advantage in the matter of marketable grain, but in respect of value for seed purposes the cobs from the heavy sowing were much smaller, not so well filled, and more difficult to harvest.

Similar experiments were conducted at Glen Innes Experiment Farm in the same season, the seed being sown on 22nd October and the cobs harvested on 17th June. Three different quantities of seed were sown at this farm, and the results, in percentages, were as follows :—

Three grains every 43½ inches	(9 lb. seed per acre)	 100
„ „ 56¼ „	(6 lb. „ „)	... ... 103·1
„ „ 28 „	(11 lb. „ „)	... ... 117·2

The heavy sowing was therefore again the most profitable.

—R. G. Downing, Senior Experimentalist.

Recent Trials with Grain Sorghums.

Season, 1920–21.

J. N. WHITTET, Assistant Agrostologist.

The results obtained at experiment farms during the past season again go to prove that the grain sorghums have many good points to recommend them to farmers.

One of the main reasons why a greater area is not sown in the State is that farmers are not aware of their uses either as grain or as green fodder crops. As a summer fodder in dry districts these sorghums are exceptionally useful, and the value attached to them in other parts of the world is indicated by the fact that in the United States of America no less than 5,000,000 acres were sown either for green feed or for grain in 1919–20. The average acre-yield in America varies from about 500 lb. of grain in bad seasons to more than twice that quantity in a favourable year, the best results being obtained where the rainfall is about 25 inches and the elevation 2,000 to 2,500 feet.

Good results have again been obtained this year at Bathurst, Cowra, and Coonamble experiment farms. Milo stands out as the best variety this season, but careful selection work is necessary with this variety, as it tends to produce a large number of pendant heads. Standard Milo is the strain now grown by the Department, and it is characterised by a uniform height of from 4 to 5 feet under dry conditions; the heads are large, compact, and very heavy, with grain yellowish-brown in colour.

Feterita still continues to give satisfactory yields, and although not making the same amount of growth as Milo, has in the past proved to be a good drought-resister. In habit of growth it somewhat resembles Milo, although its heads are always erect and more elongated; its grain is bluish-white in colour.

Cowra Experiment Farm.

Mr. C. McCauley, Experimentalist, reports:—An experiment was conducted to determine the most suitable variety of grain sorghum for this district, and the most suitable distance between drills. In one section seed was sown at the rate of 5 lb. per acre in drills 4 ft. 1 in. apart; and in another section the seed was sown at rate of 8 lb. per acre in drills 2 ft. 11 in. apart.

The land had been previously cropped for Bokhara clover, and was ploughed in July, 1920, spring-tooth cultivated in August, and disc-cultivated and harrowed in October.

Specially selected seed from the 1919–20 crop was sown with the wheat drill on 14th to 18th October, superphosphate being also sown at the rate of 60 lb. per acre. Owing to the ideal climatic conditions which prevailed

during the growing season the plants made vigorous growth, but the yields were somewhat reduced by a heavy growth of weeds in the section where the seeding was light, and the space between the drills wide. The following yields were obtained:—

	Drills 4ft. 1in. apart. Grain per acre.	Drills 2ft. 11in. apart. Grain per acre.
	lb.	lb.
Milo	1,345	1,676
Feterita	706	1,791
Manchu Kaoliang	159	627

The Milo variety produced the best average yield of the three sorghums Germination was good and a vigorous growth followed. The plants stooled

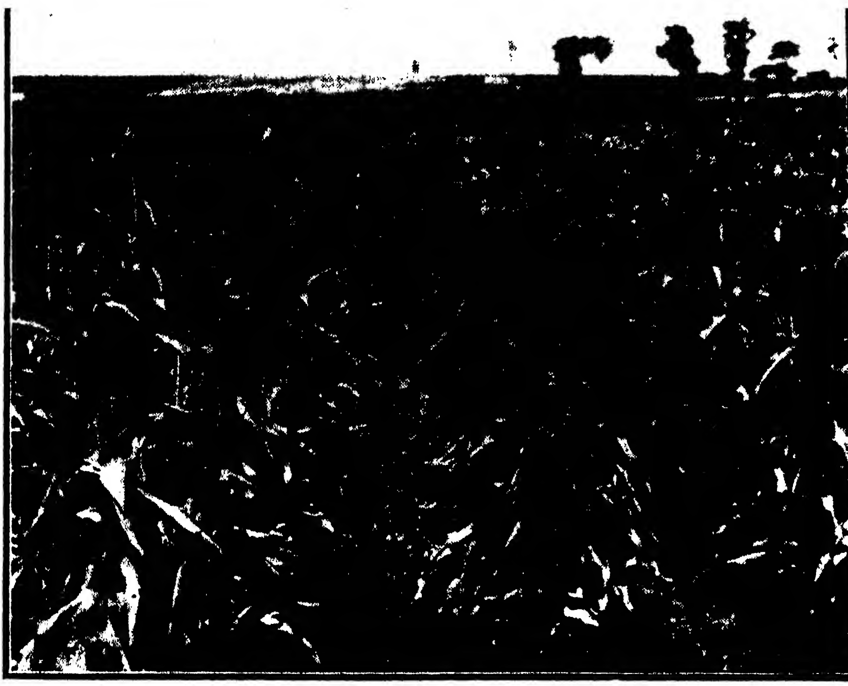
Milo at Cowra Experiment Farm.

well and averaged 5 feet in height; stalks fairly juicy, and leaves abundant; heads were large and compact, grain large and plump. This variety should produce more green fodder per acre than either Feterita or Manchu Kaoliang; it has proved very suitable for this district.

The germination of Feterita was good, but the growth not as vigorous as either Milo or Kaoliang, and at harvest time the crop was only 3 ft. 6 in.

in height. The heads were very even in type, erect, large, and compact; seed large and plump. Like Milo this variety has proved suitable for the district.

Manchu Kaoliang yielded very poorly. Germination was good, and quick growth followed and reached a height of 7 feet. The stems were dry and pithy, the leaf growth scanty, and the plants exhibited a tendency to lodge just before the seed ripened; the heads were loose and erect; seed small. The variety is unsuitable for this district, either as a fodder plant or as a source of grain supply.



A crop of Feterita at Cowra Experiment Farm.

The rainfall during the growing period was—18th to 31st October, 242 points; November, 155 points; December, 616 points; January, 116 points.—Total, 1,129 points.

Bathurst Experiment Farm.

Mr. L. F. Rowney, Experimentalist, reports that the crop previously grown on the land was Algerian oats for fodder. The land was ploughed in August, and was worked prior to planting. Specially selected seed was sown on 25th October with the maize dropper, set to sow at the rate of 6 lb. sorghum seed per acre; one acre of each variety was sown—one-half acre in drills 3 ft. apart, and one-half acre 4 ft. apart.

The germination was good throughout. Manchu Kaoliang grew to 8 feet in height, the section in which the drills were 3 feet apart making the tallest growth. The best and heaviest heads were to be found where the drills were 4 feet apart.

Milo did not make nearly the same amount of growth as Manchu Kaoliang, but large, well-filled heads were produced in both plots.

	Drills 3 feet apart. Grain per acre.	Drills 4 feet apart. Grain per acre.
	lb.	lb.
Milo	2,040	2,260
Manchu Kaoliang	1,287	2,014

The rainfall during the growing period was—25th to 31st October, 53 points; November, 149 points; December, 548 points; January, 219 points; February, 65 points; March, 263 points.—Total, 1,297 points.

Coonamble Experiment Farm.

Mr. R. W. McDiarmid, Manager, reports that two varieties, Milo and Manchu Kaoliang, were grown under irrigation at this farm. The land was ploughed dry, and after preparing the seed-bed, drills were opened out with a plough; seed was drilled in on 31st December at the rate of 4 lb. per acre, no fertiliser being used. The drills were 4 ft. apart, and the seed was sown with a maize planter, fitted with a sorghum planting plate.

Ten days after planting, sufficient water was applied to the drills to soak the soil around the seed thoroughly, and a good germination was obtained. When the plants were well established the crop was harrowed. A second watering was given on 4th February, and from then on the rainfall was sufficient for the crop's requirements.

The rainfall during growth was—January, 94 points; February, 155 points; March, 455 points; April, 328 points.—Total, 1,032 points.

The crop was harvested on 7th May, dried under cover, and threshed with a machine similar in construction to a broom millet hackler.

The yields were:—Milo, 2,932 lb. grain per acre; Manchu Kaoliang, 1,820 lb. grain per acre.

Several varieties of maize were grown alongside under exactly similar conditions, but they returned only 3 bushels of grain per acre. The failure of the maize was due mainly to faulty germination and to the depredations of cutworms, which did not cause any appreciable damage to the grain sorghums.

Wagga Experiment Farm.

Mr. E. S. Clayton, Experimentalist, reports that trials were conducted (*a*) to determine the most suitable variety for the district, (*b*) the most suitable width to plant the rows, and (*c*) the most suitable distance apart to have the plants in the rows.

The land received a short fallow and was in good condition at the time of sowing. The seed was sown with the wheat drill on 27th October, superphosphate being also applied at the rate of 56 lb. per acre. When the plants were 6 to 8 inches in height the rows were thinned to 3, 6, 9, and 12 inches between the plants. The rows were cultivated twice to check weed growth and conserve moisture. The rainfall for the growing period was 7½ inches.

The varieties (which matured in following order: Manchu Kaoliang, Feterita, Milo) were harvested at the end of February.

Variety.	Rows 3 feet apart.		Rows 4 feet apart.	
	Distance apart of plants in rows.	Grain per acre.	Distance apart of plants in rows.	Grain per acre.
	inches.	lb.	inches.	lb.
Manchu Kaoliang	3	378	3	384
	6	441	6	480
	9	567	9	576
	12	630	12	624
Milo	3	693	3	624
	6	756	6	673
	9	819	9	816
	12	945	12	912
Feterita	3	693	3	624
	6	693	6	672
	9	819	9	672
	12	882	12	720

The average yields were :—

	Rows 3 feet apart. Grain per acre.	Rows 4 feet apart. Grain per acre.
	lb.	lb.
Milo	803	756
Feterita	772	672
Manchu Kaoliang	504	516

Nyngan Experiment Farm.

Mr. J. Douglass, Assistant Experimentalist, reports that the land was ploughed on 8th and 9th June. The soil was in good condition, and good rain fell on the fallow. The seed-bed was prepared with the disc-cultivator.

The seed was sown with the wheat drill on 3rd and 4th November in drills 3 feet apart, using about 4 lb. of seed per acre. The germination was good on all plots. Two intercultivations were given, one on 29th November and the other on 6th January. The plots were harvested with the reaper and binder on 17th February, sheaves stooked and later threshed.

The yields were :—Feterita, 190 lb.; Milo, 118 lb.; Manchu Kaoliang, 105 lb.

The low yields obtained were due to the attacks of large flocks of sparrows just prior to the grain reaching maturity.

Feterita made fair growth and set good heads of seed. The plants stooled well, but did not attain the same height as the other varieties.

Milo did much better than the actual yield indicates. The average height of the plants was 5 ft. 3 in., and they stooled well and produced large, well-filled heads.

Manchu Kaoliang made good rapid growth, but the plants did not stool well, and heavy wind caused many of them to lodge.

Conclusions.

Milo, Feterita, and Manchu Kaoliang are the three main varieties grown at the present time in New South Wales. Of the three, Milo is conspicuously the best grain or dual-purpose variety.

As substitutes for maize grain these sorghums provide excellent feed for all classes of stock. In feeding to pigs and poultry the grain is not always threshed from the heads, although crushed grain is more easily digested and less wasteful for feeding to all classes of stock.

Feeding tests carried out in America show that the grain sorghums have 90 per cent. of the feeding value of maize for fattening cattle and pigs, and from 90 to 95 per cent. for fattening lambs. The feeding value of maize and Milo varied but slightly, coming in the order named. Feterita and Manchu Kaoliang gave satisfactory results, but did not equal the other grains; sweet sorghum seed proved decidedly inferior to maize and the grain sorghums.

Seed should be sown as soon as all danger of frost is over. With early planting the plants become well established before the hot dry weather sets in. A light seeding of about 4 lb. per acre in dry districts gives the best results; the results obtained at Wagga indicate that a light seeding is beneficial.

Although an increase in yield is shown at Bathurst where the crop was planted in rows 4 feet apart, on the other hand the Cowra results, from a similar width of rows, were considerably diminished through the enormous growth of weeds that took place. The wide space between the rows encouraged weed growth, whereas with rows 3 feet apart the growth of the crop tended to shade the intervening spaces between rows and to check weed growth.

For green fodder the grain sorghums are valuable crops to grow, either for pasturing stock when the plants are in head, or for harvesting the grain and feeding the stalks to stock. Pasturing the crop when it is carrying a large quantity of seed, however, is a wasteful practice, as a considerable amount of the grain is then lost.

As the value of the grain sorghums comes to be realised by farmers, it is safe to anticipate that extensive areas will be sown. The crop provides excellent green feed and grain for all classes of stock.

Some Notes on the Potato-growing Industry.

A. J. PINN, Inspector of Agriculture.

THE following notes had their genesis in a report submitted by the writer on his return from a recent conference of potato-growers in Tasmania. Concerning the conference itself, it is only necessary to say that, although the single day to which it was limited was all too short for the adequate discussion of the many aspects of the industry brought forward, the occasion is bound to react to the advantage of the potato-growing communities represented by the two hundred growers who attended.

The Tasmanian Government afforded me every facility for touring the potato districts of the State, and certain things came under notice that are quite worth the serious attention of New South Wales growers.

First, a word as to the measures affecting the export of Tasmanian potatoes overseas. Just as it is necessary for potatoes grown in our New England district to be inspected for freedom from disease before being admitted for sale in Queensland, so also is it necessary for potatoes from other States to be submitted for inspection before being admitted to New South Wales. Such systems of inspection of interstate exports and imports not only protect the importing State, but also the growers of the produce, for they reduce to a minimum any chance of a consignment, or portion of it, being condemned, and consequently acting as a deterrent to further trade. The Department of Agriculture in every exporting State recognises this, and Tasmanian potato-growers are required, in their own best interests, to submit their produce to a thorough process of inspection and a rigid system of certification of cleanliness. In some cases this inspection takes place not only at the port of shipment, but also before the consignment leaves the district in which the potatoes have been grown. The education of the grower in disease-preventive measures (such as the practice of seed selection), which the Tasmanian Department is making a feature of its work, is tending still further to protect the Tasmanian potato-grower as well as the growers in States which import his produce.

The north-west district is by far the most important potato-growing portion of the island, and it is the sector that chiefly supplies potatoes to the Sydney market.

The soil, for the most part, is a chocolate loam of basaltic origin, very similar to large areas in this State, but the rainfall is better (averaging approximately 49 inches), and the season is earlier, owing to nearness to the sea, which allows of an earlier planting—a big advantage. The varieties most

largely planted are Bismarck (very early planting), Tasmanian Brownell (known to us as Adirondack), Plunkett, Commonwealth (of our Coronation type), and some Up-to-date, with small areas of other varieties. The largest area is sown with Tasmanian Brownell (Adirondack), a round variety, which causes little trouble in the matter of grading.

It was somewhat surprising to learn that the average yield of potatoes in Tasmania is now only about 2·8 tons per acre, which is little more than that of our own State. Growers are now alive to the situation, however, and are agreed that on old farms a new system of culture is necessary if improved yields are to be obtained. The outstanding deficiency in such soils is organic matter, and in order to remedy it a system of green manuring is being adopted. The practice is to sow an early crop of Algerian oats, and to feed these off lightly just previous to the planting of the potatoes, which are put in under the oat sod. This method of planting is in general practice this season. In fact, in the whole of my travels through the north-west coast, I did not see one crop planted without the turning under of green oats or pasture.

The average area planted to potatoes by Tasmanian farmers is approximately 15 acres per 100 acres of farm. The use of fertilisers is general, superphosphate being the one most commonly used, though bonedust is also used by many, and a mixture known as "nitro-super" by others. Planting is mostly done by the use of single-furrow ploughs, although double furrows are occasionally used in conjunction. The after-cultivation is similar to that given by our own farmers, but additional attention in the shape of hoeing is given shortly after the crop is above ground. This hoeing is chiefly for the purpose of loosening the soil and killing off young weeds in close proximity to the plants. The price of potato land averages about £35 per acre, and it is let at an annual rental of about £2 per acre.

The chief factors contributing to the success of the Tasmanian export potato trade to New South Wales are (1) the grading, (2) the method of sale in Sydney, and (3) the earliness of the crop. Tasmanian potatoes are not graded under Government regulations, and a motion in that direction at the recent conference raised a storm of comment, and was ultimately declared lost. The system of inspection to which the product is subjected, however, has had the effect of bringing about closer attention to grading, growers realising that unless they can place on the market a product of consistently sound quality it will be impossible for them to hold their trade connection in competition with Victorian and New South Wales produce. If the contention that grading is of prime importance needs support it is supplied in the fact that potatoes from our own New England district (where the system of inspection in force has automatically encouraged grading) can compare favourably with the Tasmanian product. The question arises whether the system of inspection now operating in New England should not be extended throughout New South Wales, so that no potatoes which have not first been inspected could be submitted for sale in the Sydney or Newcastle

districts. There would appear to be little doubt that by this means such an improvement would be brought about that the whole of the local potatoes sold on these markets would in time compete successfully with the graded interstate produce. Certainly greater attention in this respect is needed on the part of New South Wales growers—New England, of course, apart.

The selling of Tasmanian potatoes on the wharves by a limited number of agents is a distinct advantage to the imported produce. It is often asked why potatoes from other States are worth so much more than the local product, and there is no doubt that the question would in part be answered by a visit first to the wharves, where the interstate supplies are unloaded, and then to the Alexandria railway yards, where the local produce is sold. Not only are the interstate potatoes well graded, of good shape, free from dirt, and put up in new bags, whereas most of these features are lacking in the New South Wales product, but the interstate produce has the important advantage that the wharves are situated close to Sussex-street, in close proximity to most of the commission agents. The potatoes are able to remain in position on the wharf for a considerable period, and it is not necessary to force sales, whereas our own produce, auctioned at Alexandria, must be sacrificed at almost any price if the offerings are larger than what constitutes the day's demand. The only alternative is to cart from rail to store, which entails a large expense (ultimately to the grower), and, in any case, is not possible where agents have limited storage room.

The question of providing a suitable central potato mart, offering facilities for unforced sales and the minimum of handling, should receive serious consideration, and greater discussion than is possible here. The problem presented above has many ramifications, and all have a more or less direct relation to the grower. Whatever the ultimate solution, there can be no doubt that a growers' association, comprising all the growers of the State, would be powerful to do much on this one count alone.

Early planting of potatoes on the Tasmanian north-west coast allows of the produce coming on to our markets months in advance of those from our main tableland districts, and, there being little local competition, the prices obtained are usually most satisfactory. One may venture to predict a big future for potato-growing in the Dorrigo district of this State. Once the rail connection now in course of construction is completed, this section of country will have every advantage possessed by the best parts of Tasmania, and by being shipped from Coff's Harbour the produce could be sold on the wharves under the favourable conditions now applying to the interstate produce. Judging by what the writer has seen of the potatoes produced on the Dorrigo, they lack nothing on the score of quality, and it can be said that that district has facilities generally that compare with the most favoured potato-growing districts of Tasmania. If well-graded samples are forwarded in clean bags, it ought to be possible to market potatoes of a quality equal to the interstate product, and to do it at a lower cost.

A comparison of marketing costs generally shows that the bulk of the New South Wales growers are at a distinct advantage. The expenses attached to the forwarding of Tasmanian produce after leaving the farm may be seen from the following figures, quoted from a Tasmanian farmer's account sales:—Tasmanian side—Rail freight, 6s. 2d. per ton; unloading, 9d.; inspection, 1s. 3d.; wharfage, 2s.; insurance, 9d.; boat freight, £1 6s.; bill of lading, 6d. Sydney charges—Inspection, 1s. 6d.; wharfage, 4s.; weighing, 6d. Total, £2 4s. From an analysis of the foregoing figures, it will be seen that local produce can be placed on the Sydney market at a lower cost, as many of the charges enumerated above will not exist, while others (more particularly boat freight) should be much less than those shown.

New South Wales growers may be warned in conclusion to pay more attention to varieties suitable for the market, and such sorts as Magnum Bonum, now largely grown in the Crookwell district, will need to be eliminated. This potato though a heavy yielder, is almost unsaleable at the time of writing, on account of its unattractive appearance. Better take pattern from the Tasmanian farmer, who is growing potatoes that are of good shape, and easily made into a good marketable sample by the diggers without further handling. Such a sample usually commands £2 to £3, or even more, in excess of our own present-day product. As a matter of fact, some ungraded samples of locals are actually down to 2s. per cwt. as against 9s. for the Tasmanian article.

Vineyard Notes for December.

One notes with pleasure that the climatic conditions experienced this season to date have been almost normal and comparatively dry, as compared with the conditions in 1920. Such weather has aided the vine man in many respects. He has been able to complete his ploughings early, and consequently to push ahead with the sprayings and cultivation, while the fact that the weather has proved unfavourable for fungus development has lessened the number of sprayings necessary. So far, appearances of vine fungi have been practically nil, but it should not be taken for granted that conditions will be similar throughout the season. Those who have not yet sprayed should attend to the operation without delay. Should other conditions come along, and the weather prove humid and muggy, the unsprayed vineyards may receive a more or less disastrous knock.

Under the influence of the warm sunny days, weeds and summer grass will grow very rapidly, and require periodical attention to keep them in hand; working the cultivator and hoe early in the season saves much trouble and annoyance later.

All young budded and grafted vines will require attention frequently in the shape of disbudding and tying to stake or trellis. Neglect to tie them may result in the wind destroying the shoot, and levering it out at the union. In the case of grafts that are not showing through yet, the soil mound should be prevented from caking, so as to allow an easy passage for the young and tender shoot.—H. L. Manuel, Viticultural Expert.

Cheesemaking on the Farm.

(Continued from page 806.)

J. G. McMILLAN, M.B.D.F.A., N.D.D.

Cutting the Curd.

WHEN to cut the curd is an important point. If it is cut too soon loss will be incurred, and if when too firm there is similar danger, and in the latter case the curd will also run before the knives, making even cutting impossible. To ascertain when the curd is sufficiently firm, insert the index finger immediately under and along the surface and just touch the curd with the point of the thumb, gradually raising the finger horizontally. When ready the curd should make a clean break, leaving a clear whey; if particles of curd stick to the finger and the whey is white in colour, then the coagulum is not ready for the cutting process. Another test is to place the back of the hands and fingers on the curd close to the edge of the vat and apply gentle pressure, when the curd should leave the side of the vat cleanly. A good reliable test is to multiply the number of minutes from the time the rennet was added until the coagulum began to form by one and a half. Supposing such time to be fourteen minutes, then one and a half times that would be twenty-one minutes: 21 plus 14 is 35—that is, thirty-five minutes from renneting until cutting.

The curd is cut with specially constructed knives, made of steel. The reason for the blades being arranged on one knife in a horizontal position and in the other vertically, is so that the curd when cut will be in small cubes as nearly even in size as possible to allow of even cooking. Some makers use the horizontal knife first, others the vertical, but (although the writer prefers the first-mentioned method) it really does not matter which plan is practised as long as the desired object is attained. When inserting the horizontal knife, do not put it straight down into the curd, or the latter will be bruised; use the knife with a quarter-circle motion. With this knife the cutting is done lengthways, the knife being held firmly and straight and pushed along. When the other edge of the curd is reached turn the knife round in the curd, returning to the edge from which the cut was started with one part of the knife in the track of the original cut, continuing in this fashion until the whole of the curd has been gone over. Lift the knife out with a quarter-circle action. The curd is now in thin flakes about three-sixteenths of an inch thick. The vertical knife is then drawn through the curd; at each end it should be lifted out and the curd should be so cut as to avoid overlapping of the cut. The curd should now be in long strips. The next action is to cut crossways with the vertical knife, lifting the knife out of the curd at each cut as before. The cross-cutting should be done

fairly rapidly, so as to prevent the curd running in front of the knife. If the cutting has been carefully done, the curd (if properly firm) should now be in small even-sized cubes. The three cuts are generally sufficient, except in the case of over-ripe milk, when one or two extra cuts are given.

Cooking the Curd.

The next procedure is to empty the tap, pour contents into the vat, and commence stirring the curd gently with the hands, rubbing it off the sides of the vat and bringing that at the bottom towards the surface. Should any large particles appear these should be gently broken into small pieces with the fingers; if, however, these large pieces are numerous it is better to give another cut with the knife. Cutting is done to assist in the expulsion of whey, and should it be done irregularly it is obvious that at the end of the cooking process the whey will be more completely expelled from the small particles than from the large. If large uncooked particles get into a cheese it follows that ripening will be irregular, some parts of the cheese being riper than others. After stirring a little with the hands a test of the whey should be made. It will be noted that the whey at this stage will show from ·07 to ·08 points less acid than did the milk —that is, if it took twenty spaces of alkali to neutralise the acid in 8·75 c.c. of milk, in the whey at this stage it would take only twelve or thirteen spaces. The whey at this stage should be of a greenish-yellow colour, and not milky. The rapidity with which the curd sinks is an indication of how rapidly it is going to work. The acid test also is a guide. Suppose the milk was renneted at ·2 per cent. acid, and the whey when tested showed ·14 to ·15 per cent. of acid to be present instead of ·12 or ·13 per cent., then it is a sign that acid is developing rapidly, thus requiring probably an extra cut, also the hastening of the cooking process. Heat is now applied by turning steam or hot water into the jacket of the vat. When steam is used it is better to have water in the jacket than to heat with steam direct. Direct steam heats the tinware to a high temperature, and is liable to cause scorching of some of the curd. When the curd is cut a film forms on the outside of the cubes, which allows moisture to escape, but prevents the escape of the fat. If heat is applied too rapidly

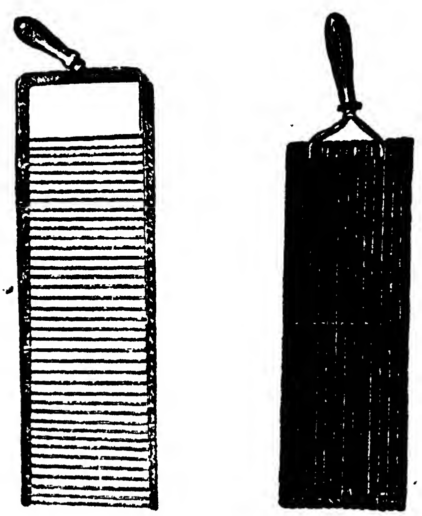


Fig. 15.—Curd Knives.

A.—Horizontal Knife. B. Perpendicular Knife

(*After Decker.*)

this film is hardened and the escape of the moisture prevented. It is, therefore, necessary to apply heat steadily in the initial stage, raising the temperature at the rate of 2 deg. every five minutes until 90 deg. Fah. is reached, when the process may be hastened, the desired temperature being reached in from thirty-five to forty minutes from the time heat is applied. During the heating process the curd should be kept thorougly stirred with the rake and for a few minutes after the proper point has been reached. If allowed to settle immediately the curd settles on the bottom of the vat (which is warmer than the contents) and thus a certain amount of fat may be lost. It is generally advisable to turn the steam off when the temperature is about 1 deg. off the desired point; the heat of the water in the jacket should be sufficient to raise the curd the extra degree. Stirring is done to obtain equal distribution of heat and acid development. During the stirring process the tap of the vat should be frequently emptied and its contents transferred to the bulk for reasons already mentioned.

The temperature of cooking a normal working curd varies from 98 to 102 deg. Fah., the richer the milk is in fat the higher being the temperature. Milk obtained from cows grazed on clay soil pastures requires a higher

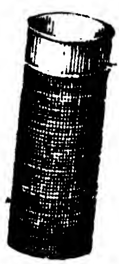


Fig. 16.—Curd Strainer.
(*After Oliver.*)

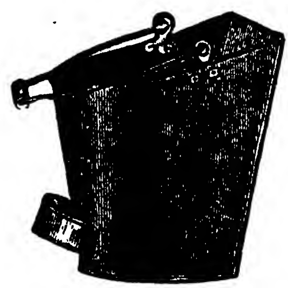


Fig. 17.—Curd Bucket.
(*After Decker.*)

temperature than that from cows grazed on soils rich in lime, and milk from animals feeding on flat country will generally require a higher temperature than that obtained from those on hilly country. The cheesemaker with experience will soon be able to tell when the temperature is right. The lower the temperature of cooking (provided the proper body is obtained in the curd) the better the results.

After heating and stirring is completed the curd-strainer should be placed in position and a test of the whey made. Should, in the opinion of the maker, the acid be developing too fast to allow of proper cooking, about half the whey should be drawn and the temperature raised another 1 or 2 degrees. If, however, the acidity has only risen, say, from 12 to 14 degrees conditions will be satisfactory. The vat should be covered over, and every ten minutes or so the curd should be stirred up with the hands and examined for acid. Meantime the whey conductor should be placed in position and all utensils for the removal of the whey got ready.

Drawing the Whey.

The drawing of the whey at the proper stage is the most important part in the process of cheddar cheesemaking. By this time, owing to the expulsion of the whey by the action of both heat and acid, the particles of curd will have shrunk in size. When a portion is taken in the hands it should be quite firm, so that it can be rubbed between the palms without quashing, and when a particle is placed between the teeth it should " squeak " like a piece of rubber. The particles of curd will tend to stick together, a handful held downwards having the appearance of a bunch of grapes. The acid in the loose whey will be about ·18 to ·19 per cent., and the curd will show about ¼ inch of fine threads on the hot iron, due to certain chemical changes produced in the casein by the action of the acid. The hot iron test was first introduced by Professor Drummond, of Kilmarnock Dairy Institute, who still considers it the best test. The test is performed as follows :—Procure a piece of shoeing iron about 2 feet long, place in a fire, and heat to a black heat. Meantime get a small quantity of curd and squeeze same in the hand until a consolidated mass with smooth surfaces. Take the iron from the fire, wipe it with a cloth to remove all dirt, and apply a corner of the curd. If, when the curd is drawn away, a brown colouration is left, that part of the iron is at the proper heat. On the opposite side of the iron then apply a whole surface of the curd, rubbing it on firmly with a circular motion, and without stopping this motion draw the curd and iron apart. If the degree of acidity is correct it will be seen that fine threads about ¼ inch long will adhere to the iron. This is a test the carrying out of which requires practice. Always have the iron the proper heat and free from dirt and grease; it should be held in such a position that it can be kept steady. Do not perform the test in a draught, or the threads will break.

The proper degree of acidity having been obtained, no delay should be incurred in removing the whey. While this is proceeding the curd should be stirred up so as to break up all lumps. Once the whey is removed the curd should be drawn to the lower end of the vat and a rack covered with a cheese cloth, on to which the curd is lifted with a scoop or curd bucket, placed in the bottom of the vat. It should then be stirred again to break up large lumps and assist in the removal of excess whey, being placed when sufficiently dry in a heap about 6 inches high. This heap should be as level as possible—that is, the depth should be the same all over, and all particles of curd should be swept up in the vat with a millet broom and placed on the heap. The exact depth of the heap of curd will depend upon its condition—the firmer and drier it is the deeper it may be and the less stirring it will need. On the other hand, when the curd is inclined to be soft it should be stirred more thoroughly and not heaped so high.

This is the beginning of the cheddaring process. The whey running from the curd at this stage will show an acidity of from ·25 to ·28 per cent. The writer has recommended the use of racks because he considers that better results can be obtained than by cheddaring on the bottom of vat. By use of the racks the whey is enabled to drain away better and does not lie in

pools around the particles of curd, thus allowing of a better chance to obtain an even development of acid and a good body in the finished cheese. At factories where there is difficulty in obtaining a firm body in the curd the use of racks will be of great assistance. The two factories which, in the writer's opinion, produce the best textured and bodied cheese in the State of New South Wales, use racks. Some other factories, however, that produce good bodied cheese do not use racks, but one of the latter obtains its milk supply from hilly country. Certainly factories dealing with milk from flat country should always use racks. In Great Britain racks are used all the time, and if they are found to be beneficial in a cool climate, in a hot country such as ours their use should be still more necessary. Were the writer going in for cheesemaking on his own account he would have a tin-lined curd sink and the racks set in this, the curd being lifted from the vat on to these racks and all subsequent treatment done thereon; this would allow the making vat to be washed, and as neither salt or high acid whey would come in contact with the tin the life of the vat will be greatly prolonged.

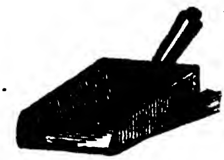


Fig. 18.—Curd Scoop.
(*After Decker.*)

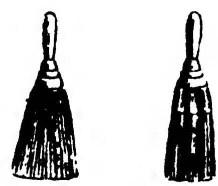


Fig. 19.—Curd Whisk.
(*After Oliver.*)

In about twenty minutes after placing it on the rack the curd will have matted together. It is then cut into blocks of an even size, from 6 to 8 inches square. These blocks must be carefully turned over, the outer sides of the blocks being placed inside so as to maintain an equal temperature throughout; all small particles should be swept up and placed under them. With a properly firm curd the blocks are doubled in another fifteen minutes, and they are again turned and redoubled, and so on, every fifteen minutes. The curd must be kept covered and everything done to maintain an even temperature, and no loose particles should be allowed to lie about, as such particles would have a different acidity and texture from the rest of the curd. Sometimes cheddaring is delayed if the curd has been dried too much; by placing a rack with weights thereon on the curd the cheddaring will be greatly assisted.

During the cheddaring period great changes will have occurred in the curd and from a granular condition it will have turned into a stringy like mass. From one and a half to two hours after placing it on the racks the curd should be ready for the milling process. At this stage one ought to be able to tear it into flakes similar to lean meat or the breast of a chicken; it should draw about 1½ inches on the iron and have a distinct acid smell.

The more solid and free from holes the better for the curd. When small round holes are present in any quantity it is called "pin holey," and gives cheese of inferior flavour.

Milling.

Milling is done to reduce the curd to particles so as to allow of easy salting; there are several kinds of mills, but the one in general use is that illustrated. The blocks of curd are cut to such a size as to go easily into the hopper; then by turning the handle it passes through in strips of about 3 inches long. After milling the curd is well stirred by hand for several

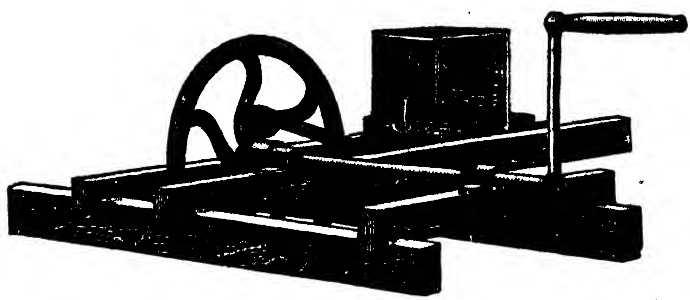


Fig. 20.—Curd Mill.

minutes, which assists in its aeration. If salted immediately after milling the texture of the cheese will be affected. The curd should be stirred up every ten minutes. In from half an hour to three-quarters of an hour after milling the curd will have mellowed down and will have a velvety feel, and it will be noted that some of the particles have a tendency to curl up. A certain amount of whey will exude; this should be tested, and if it shows about ·9 per cent. of acid (that is, takes 90 spaces of alkali to neutralise the acid) it is in fit condition to salt. It is most important that the right amount of acid be developed at this stage as the amount to develop depends on the moisture content. With a curd rather soft at the drawing of the whey, ·7 per cent. of acid might be sufficient at salting; with a firm curd at this stage as much as 1 per cent. acid may be developed with safety. Unfortunately, some makers have the opposite and quite erroneous idea.

Salting.

The temperature of the curd will now be about 85 to 90 deg. Fah. Salt is added at the rate of 2½ to 3 lb. for every 10 gallons of milk, and it should be well distributed over the surface of the curd and thoroughly stirred through for two or three minutes, the curd being allowed to lie for about ten minutes until the salt has dissolved. and then stirred well again. A rather coarse salt should be used, as it melts more slowly than a fine one, and therefore has a better chance to reach the centre of the curd particles, whereas fine salt (particularly where too much whey is present) will melt quickly, passing away in the whey before it has effected its work. The curd should now be firm, and when pressed firmly with the closed hand it should spring back like rubber; it should also have a glossy appearance.

(To be continued.)

Field Experiments with Sweet Potatoes.

Grafton Experiment Farm.

N. BOYCE, Experimentalist.

A trial of five new varieties of sweet potatoes received from America was carried out at this farm last season, the objects of the experiment being to determine the best varieties as to quality and yield and to produce tubers for further trials. The roots were in sound condition when received and many of them were advanced in sprouting.

In order that sufficient "plants" might be produced to carry out the trial, the tubers were planted in a propagating bed, prepared by placing in the bottom of the frame fresh stable manure to a depth of 4 inches and covering this with 3 inches of light sandy loam. The tubers were placed on top of the loam, close to one another, but not actually touching, and covered with sandy loam to a depth of 2 inches, the whole bed then being watered.

The trial was carried out on the red volcanic soil of the farm; the land had been well prepared and was in an excellent state of tilth. Planting was carried out on 27th October, 1920, the plants being carefully drawn from the bed and dibbled into the prepared land with a spade. The size of each plot was approximately a fortieth of an acre. The rows were 3 feet apart and 64 yards long, and the plants 2 feet apart in the rows.

A splendid rainfall was recorded and ideal conditions prevailed up till the middle of May, when heavy flood rains fell, water-logging the soil and causing many tubers to rot. The rainfall was as follows:—27th to 31st October, 23 points; November, 485; December, 129; January, 735; February, 136; March, 277; April, 508; May (up to 27th), 1,926. Total, 4,219 points.

Harvesting was carried out on 27th May, 1921. Many of the tubers were in a badly decomposed state on account of the heavy rains of May. The yields were as follows:—

Variety.	Yield (lb.) per Plot.	Yield per acre.			
		t.	c.	q.	lb.
Triumph	945	15	18	0	10
Southern Queen	661	11	2	2	27
Nancy Hall	428	7	4	0	8
Yellow Strassburg	786	13	4	2	8
Porto Rico	836	14	1	2	17

The Varieties.

Triumph gave the highest yield. It makes vigorous growth. The leaves are of medium size and ivy-shaped; and the roots are of good shape, white in colour, and of fair keeping quality.

Southern Queen is a fairly productive variety, bearing abundant vine growth and large leaves. The roots are of good shape and size, cream colour, midseason maturing; a fair table variety, and a good keeper.

Nancy Hall is a poor cropper, producing small, chunky, cream-coloured roots. The vine growth is vigorous, with large flattened leaves; a fair table variety, and a good keeper, maturing in midseason.

Yellow Strassburg is a good yielding variety, producing long yellow-coloured roots. The vines are abundant, with large leaves; midseason maturing. This is the best table variety in the trial.

Porto Rico is a vigorous and very productive variety. The leaves are large, of the ivy-shape type; roots golden in colour and spherical in shape, large and inclined to crack; midseason in maturity. It is a good table variety and a good keeper.

Winter Fodder Trials at Nyngan.

Experiments were carried out last season at Nyngan Experiment Farm with the object of determining the most suitable crop for winter fodder in the district of which the farm is representative. The paddock used for the experiment was running under a three years' rotation and had previously been occupied by Federation wheat. It was stubble fallowed from November, 1920, to February, 1921, mouldboard ploughed to a depth of 6 inches on 8th February; spring-tooth cultivated on 25th February across the ploughing, disc-cultivated on 15th March in the same direction as the ploughing, plank-dragged, and sown on 16th March with a hoe drill. The seed-bed was rather dry but in good condition; superphosphate at the rate of 30 lb. per acre was sown with the seed. Good rains fell early in April and all the plots germinated well. On the worked fallow 205 points of rain fell, and the precipitation during the growing period was good.

Firbank wheat was sown on the check plots at the rate of 45 lb. per acre, and taking the percentage yield of these plots as 100, the crops under trial gave percentage yields as follow :—Rape (sown at the rate of 4 lb. per acre), 242 per cent.; mustard (at 4 lb. per acre), 231 per cent.; Barley No. 36 (at 30 lb. per acre), 177 per cent.; Sunrise oats (at 30 lb. per acre), 176·2 per cent.; Skinless barley (at 30 lb. per acre), 135·6 per cent.; and Hard Federation wheat (at 45 lb. per acre), 86·3 per cent.

Portion of the plots were fenced off, and a feeding-off trial with sheep somewhat qualifies the foregoing as to order of merit, the fodders being preferred by the sheep in the following order :—Skinless barley, Sunrise oats, Barley No. 36, Firbank wheat, Hard Federation wheat, rape and mustard. The mustard was in flower during the feeding-off test, and the plants were stripped of their leaves and the more tender stems eaten, the main stems being left standing.—G. Nicholson, Experimentalist.

Banana Fibre.

G. P. DARNELL-SMITH, D.Sc., F.I.C., F.C.S., Biologist.

SOME interest has been aroused recently in the banana-growing districts of the Tweed in the possibility of banana fibre having a commercial use. After a stool has thrown its bunch and the bunch has been cut, there remains the stem, and it is thought that if the fibre in this could be economically obtained it might be an additional source of income.

The prospects of making use of banana fibre, however, do not appear to be very bright. W. Fawcett, in his book on "The Banana," states (p. 151) :—

The question of the value of fibre from the stem of the banana comes up again and again for discussion in the West Indies, although it was practically settled many years ago, when Sir D. Morris was Director of Public Gardens and Plantations, Jamaica. The stem yields less than 1½ per cent. of its weight, that is, about 1½ lb. per ordinary stem as cut. This fibre is described by experts as being "very weak, poor colour, and woody," and as being "only fit for paper worth about £7 or £8 per ton." To obtain 1 ton of fibre it would therefore be necessary to handle nearly 100 tons of fresh stems, which must be dealt with as soon as cut and on the spot. This, no doubt, could be managed if it were worth while, but as the local prices would probably not exceed 1d. per lb., it is scarcely likely that any serious attempt will be made to extract it.

These views were expressed in 1905 by Sir D. Morris, and since then the values of even poor fibres may have increased considerably. The fact, however, must not be lost sight of that to obtain one ton of banana fibre it would be necessary to handle 100 tons of fresh stems, while on the other hand, the chopped stem has considerable value as manure. It may possibly be that the fibre of the Cavendish banana grown on the Tweed has more value than the Gros Michel grown in Jamaica, for this fibre, when well prepared, appears to have a breaking strain not much inferior to New Zealand flax, and to have greater elasticity.

Two samples were recently submitted for examination to the Technological Museum, and the Curator (Mr. G. Hooper) has furnished a report, from which the following is extracted :—

"The banana fibres forwarded by you have been tested by the Economic Botanist, in comparison with several commercial fibres, with the following results, the breaking strain being given in kilograms per square millimetre :—

	Extension.	Breaking strain in kilograms per sq. millimetre.
	Per cent.	
Manilla Hemp	2·52	72·61
New Guinea Sisal	2·63	56·09
Java Sisal	2·66	55·07
New Zealand Flax	1·99	48·41
Banana fibre (No. 1) ..	5·13	43·18
" " (No. 2) ..	1·95	37·19

These figures are the mean of those obtained from a number of tests.

"Banana fibre (No. 1).—The extension is remarkably high, and the fibre is particularly even in area in cross section. The fibre is very clean, and free from adhering thin-walled cellular material.

"Banana fibre (No. 2).—This fibre is much inferior in general appearance to No. 1. A large amount of loose adhering cellular matter is present, and a number of the fibres gave a very low breaking strain, though some individual fibres gave very good results. The extension also is much lower, the fibres being in many cases more brittle.

"It will be seen from the figures that sample No. 1 is not very much inferior to New Zealand flax, and it possesses a much greater elasticity."

Home-made Bordeaux v. Powders and Paste.

Experiments carried out by the Department at Narara Viticultural Nursery for the past two seasons to determine what is the best preventive of downy mildew and black spot of grapes, and at what period it is best applied, show that the use of the ordinary home-made Bordeaux mixture (6-4-40) recommended by the Department, applied early in the season, is easily the most dependable method.

This season's series of experiments included the trial of home-made Bordeaux mixture, Bordeaux paste in two strengths, and two samples of Bordeaux powder, each in two strengths. The sprays were applied on 2nd and 16th December, 1920, and on 10th and 31st January, and 18th February, 1921. Between 2nd and 16th December the vines were covered with flood water three times, and the spraying of 10th January was preceded by six days of heavy rain.

The home-made Bordeaux mixture, applied before the appearance of downy mildew, proved quite effective. All the foliage was clean and complete, and forty days after the last application the spray was adhering and very few live spores were to be seen. One of the samples of powder ranked next in efficacy, and the paste was less effective again, many of the vines dropping portion of their foliage.

The application of these sprays, as stated, was begun on 2nd December, but one plot was left untreated until after downy mildew had appeared, and the result amply proved that prevention is better than cure.

As indicated, the season was a very wet one, 322 points of rain falling in November, 1,642 points (on thirteen days) in December, 719 points (on twelve days) in January, 82 points (on nine days) in February, and 511 points (on ten days) in March.

All the experience of the Department to date (at Narara and elsewhere) goes to prove that spraying with Bordeaux mixture, made in the manner described in Farmer's Bulletin No. 72, "Spraying," is the best preventive of downy mildew and black spot of the vine, and that treatment should be begun early.—R. G. Downing, Senior Experimentalist.

Cottage Landscape Gardening.

E. N. WARD, Superintendent, Botanic Gardens, Sydney.

There are many books devoted to landscape gardening, but they are of little use to the amateur who has built his home, and who is looking for information about laying out the ground in front of the building, usually spoken of as "the front garden."

For such inquirers I propose to deal with this phase of gardening, or garden-making, and to give a few plans and planting keys. The present article deals with two pieces of level ground with equal boundary lines, one (Style A) planted with a collection of choice shrubs and the other (Style B) as a rose garden.

In later articles it is proposed to discuss the treatment of a piece of ground of irregular shape and uneven contour, traversing the ground from the ideal to the worst possible, and also to treat a piece of ground that is harsh, rocky, and uneven.

The difficulty naturally presents itself of adapting any recommendations to the limited accommodation of the average suburban home, with its 50 feet or 60 feet of frontage and perhaps 20 feet or 30 feet separating the front of the house from the street, but such a section admits of somewhat limited treatment, and the present plans and lists of flowering shrubs are presented in the hope that they will be useful even where the conditions prevent their general adoption.

Most gardens in this country are made by the builder, whose chief idea of garden-making is to cover as much of the ground as possible with turf, use up some spare bricks for path edgings, cover the paths with hot and unsightly asphalt, dig a few holes to bury his rubbish, and then make these holes into flower beds. The whole surface is tidy when you pass by it, but a perpetual source of worry when you begin to grow things, because the garden has never been properly made, the subsoil being a mixture of pot holes and hard-baked pans, and the drainage therefore erratic.

Preparing the Soil.

Before attempting to lay out a garden the whole area must first be dug, trenched or sub-ploughed. Even if two-thirds of the area is to be lawn and paths, the whole should be equally treated to create an even water table. It is not always a question only of suitable root room; a faulty water-table means unhealthy vegetation, and it is surprising how many plant diseases are attributable to uncomfortable root conditions. How many times do gardeners lose in some mysterious way, antirrhinums, stocks, or asters, by a damping-off on the surface or at the spot that the gardener calls between

wind and water. In nine cases out of ten this is caused by faulty soil conditions. A bed or border is pegged out and dug—trenched if you like—on a virgin piece of ground, and during heavy or continued rain this bed or border becomes a pond, the water from which has to escape by radiation, instead of by ready filtration, such as would have taken place had the surrounding soil once upon a time been broken up. Ground once broken up by deep digging or trenching never quite returns to its natural state again; it may become apparently hard, but the pan never becomes packed as nature had it.

When the ground has been more or less spoilt for garden purposes by traffic during building operations, this working of the whole area is a most important item in cottage garden-making. Holes dug on unprepared areas, whether in front of the homestead or the suburban cottage, or on a hot, dry school playground, are certainly not proper places in which to grow plants or demonstrate cultivation. In most cases they are graves for plants to die in.

Design.

Too much should not be attempted in the small areas of the average cottage garden, but that should not prevent graceful lines from being formed.

If the reader will refer to the accompanying plans, he will see that in Style A it is assumed that the front of the house faces east, and that it is approached from the north, so that the gate leading to the front door is placed at the north-east corner, with the "back," tradesmen's or garage entrance (call it what you like) at the other corner. The curve of the path is made so that when the shrubs numbered 1, 4, 7 and 8 have grown anyone standing at the front gate cannot see the front door, so that privacy is ensured. The lines of the bed C and those on the lawns E are all in harmony.

In Style B, the house being approached from either direction, the gate is placed in the middle opposite the front door, and to secure privacy a centre bed, C, is designed. It will be noticed that the curves of the borders on lawns H are in keeping with the lines of the beds D, E, F, and G. In both cases no path has been shown on the north side of the house. Where it is necessary to walk around this side of the house from the front garden, the access should be as private as possible, simply a track from the lawn through the shrubbery or border, hidden as much as possible by judicious planting.

It is also assumed that these two styles are on level ground. It would be better if the sill of the front gate was at least six inches lower than the base of the first step leading to the front door, to facilitate surface drainage; to get such levels all that is wanted is a spirit-level, a straight-edge, and a few pegs a foot long, pointed at one end and level at the top, made out of hardwood stakes 1 inch square. With these it is a simple matter to level the whole area after the ground has been prepared.

Should it be possible to secure a fall from the base of the front step to the sill of the front gate, a perfect grade should be obtained on the surface. This is most easily secured with a set of three boning rods. These are made with 3 in. x 1 in. battens, 3 feet long, with a cross piece dove-tailed in the top,

to make a T-piece. Place one rod on the sill of the front gate and another at the base of the bottom step leading to the front door, and from either of these to the other sight over the third rod. For instance, if a grade in Style B were being prepared the third rod would be placed in the centre of bed C and when the T-piece of this rod was in perfect line with rods 1 and 2, the bottom of rod 3 would be in perfect grade with the bottom of 2 and 3 also. A stout peg should then be driven in the ground, level with the bottom of this sighted rod, and this could be made the guide peg for the whole area. A spirit level, straight-edge, and pegs will give a similar peg on the north and south boundaries.

Having levelled or graded the ground, the design should be pegged out, and the path defined with some edging, the best and most durable being bricks properly laid. The correct method is that when finished the ballast of the path comes half way up the face of the brick, which leans away from the path so that one of its long edges is uppermost. Right up to and on top of this edge, turf should be laid, so that only 2 inches of brick face is seen; in fact, so inconspicuous is this sort of edging that it is rarely noticed, and yet so effectual and durable that the path never gets out of line, and the lawn or border is always kept in its place, and, further, the grass coming right to the edge of the path and really on the top of the brick, there is no impediment to the use of the mowing machine.

Bricks used as edgings are usually seen with the flat edges uppermost, or laid with pointed corners zig-zag fashion, but in reality such borders are dangerous and ineffective, and not nearly so attractive as the one described.

For taking off surface water, sub-draining is far better than surface gutters, and a gravel face is far more desirable in this hot country than asphalt or cement, to which even a neatly laid brick path is preferable.

Planting.

There are, of course, many ways of planting such a garden as Style A. The chief point to avoid is not to plant forms of vegetable life that will be out of harmony either with each other or with the architecture. Wherever one goes one sees trees and shrubs far too large for their position, overwhelming the residence itself, darkening the windows, and robbing the soil in a merciless way.

The following would make a choice and secluded shrubbery garden in almost any place in New South Wales below the snow line*:—

A.—Hedge of *Duranta Plumieri*.

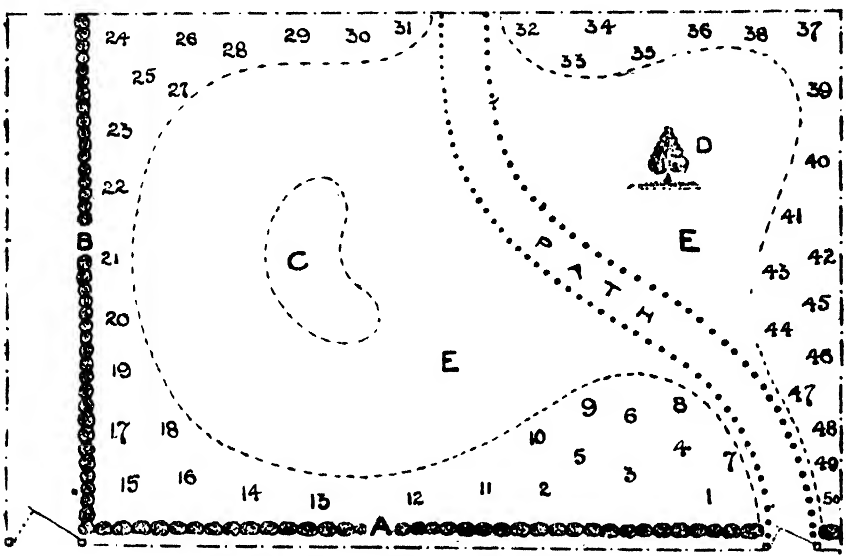
B.—Hedge of *Cupressus sempervirens*.

C.—Bed of one kind of rose—either Gruss au Teplitz for red colour and perfume, Madame Antoine Mari for habit and freedom of flowering, and Australia Felix for fragrance, freedom of flowering, and because it is an Australian-raised rose.

*For very cold districts shrubs could be substituted, such as hollies, rhododendrons, hawthorns, cypress, berberis, pæony, and hybrid perpetual roses.

D.—A specimen palm, Cocos Yatay. (1) Ligustrum lucidum (tricolor); (2) Acer negundo (variegated); (3) Jasminum primulinum (yellow); (4) Brunfelsia latifolia (blue); (5) Begonia corallina (red); (6) Lonicera etrusca (honeysuckle); (7) Ochna multiflora; (8) Strelitzia reginæ; (9) Rosmarinus officinalis (rosemary); (10) Azalia splendens (pink); (11) Magnolia stellata.

This group of choice shrubs will give colour nearly the whole year round; none would need pruning, except No. 1, which, if the soil be rich, would need controlling every few years.



Style A.

(12) A big patch of English or French Lavender; (13) Myrtus communis (myrtle, in front of which a rustic seat could be placed); (14) Escallonia macrantha (pink); (15) Prunus cerasifera Vesuvius (a double flowering, Myrabolan plum, with dark purple foliage); (16) Begonia carnea (pink); (17) Begonia Silver Spots; (18) Camellia C. H. Hovey (crimson); (19) Viburnum opulus (snowball tree); (20) Azalia Comtesse de Flanders (pink); (21) Citisus fragrans (yellow).

This corner, 14 to 21, is the hottest and driest in the garden, because it has a hedge all round it, but the above planting would make a pleasing contrast to the north-east corner.

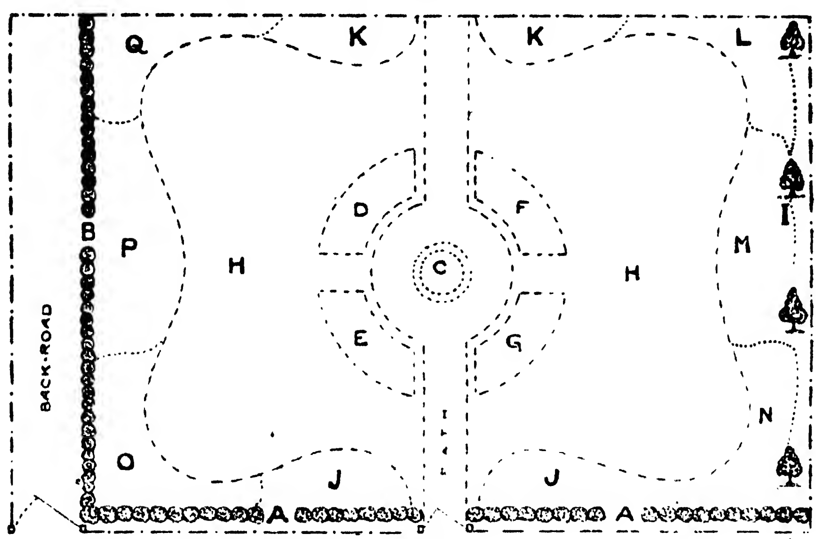
From 22 to 39 consideration has been given to plants that can do without the afternoon sun.

(22) Poinsettia pulcherrima (scarlet); (23) Fuchsia macrostemma; (24) Hydrangea hortensis; (25) Gordonia anomala (white); (26) Begonia undulata; (27) Lantana Chelsea Gem; (28) Magnolia fuscata (Port Wine Magnolia); (29) Azalia indica alba; (30) and (34) Russelia juncea (red); (31) and (32) Daphne odora rubra; (33) Turræa obtusifolia (white); (35) Hydrangea

variegata; (36) Hydrangea Reine Gaillard (white); (37) Hydrangea hortensis (pink or blue); (38) Azalia Charles de Buck (pink); (39) Azalia Roi de Holland (red); (40) Plectranthus Eckloni (blue); (41) Azalia stella (red); (42) Cassia bicapsularis; (43) Hydrangea dentele (blue); (44) Azalia Phryne (white); (45) Ceratopetalum gummiferum (Christmas bush); (46) Montanoa grandiflora (white); (47) Nandina domestica; (48) Cupressus Lambertiana aurea; (49) Fatsia japonica; (50) Tamarix plumosa.

These shrubs will in time furnish the whole ground, but until they are fully grown herbaceous plants may be grown in between, providing ample room is allowed the shrubs to develop.

Style B makes an excellent rose garden.



Style B.

A.—A hedge of Lady Brisbane or Gruss au Teplitz.

B.—Tall hedge of Tansendschon.

C.—Pillar of Zepherine Drouhin, with ground work of Borderer.

D.—Orleans rose.

E.—Madame Jules Gouchault.

F.—Ellen Poulsen.

G.—Jessie.

H.—Lawn.

I.—Ten-foot posts with chains or wire-linked between. planted with American Pillar, Excelsa, Dorothy Perkins and Hiawatha, allowing the foliage and bloom to mingle.

J.—Hadley.

K.—Hoosier Beauty.

L.—Jonkeer J. L. Mock.

M.—Radiance.
N.—Red Radiance.
O.—Gustav Grunerwald.
P.—Sunny South.
Q.—Lady Hillingdon.

Roses grouped like this, most of them fragrant, give far more pleasure than odd rose plants here and there. The effect of scattered planting is never the same, and for utility, growing batches of one kind, especially those recommended for this rose garden, will result in the gardener determining not to return to the "one of a kind" or collection style of rose garden.

(*To be continued.*)

A Tobacco Curing Query.

The successful processing of the tobacco leaf after harvesting calls for some care and accuracy. All the leaves on a plant do not ripen at once, and as individual leaves come to maturity it is advisable to pick them and subject them to the "priming" process, which consists of stringing them up in the shade of a well-ventilated barn, and prefaces drying and curing.

In a recent letter to the Department of Agriculture a grower described how he had experienced some trouble with this "priming" process. After four days the leaves had become so brittle as to break on being handled (far too brittle for subsequent handling), although they were still almost green.

For priming (explains the Tobacco Expert of the Department) the leaves should be placed close together; not until they assume a yellow colour should they be separated and dried out. If the leaves are picked green and hung up in a well-ventilated building they will probably dry out green. The stage at which to pick the leaves for the best results from air-curing is when they are greenish-yellow—more yellow than green.

If the leaves are picked when ripe and are hung shaded from the sun and close together, four days is usually sufficient for the priming process in the warmer months; but they will require to hang for some eight or ten weeks in the barn before being ready for bulking. Care should be taken that the stem or mid-rib has completely dried out. Opportunity to bulk should then be taken when damp weather has brought the leaf into suitable condition.

The Cultivation of Tobacco Plants.

After transplanting, frequent working of the soil is the secret of the best results. To keep the field clean from weeds alone is not sufficient to ensure first-class tobacco. The first cultivation should take place with the hand hoe eight to ten days after the plants have been set out. Fairly deep cultivation is desirable in the first instance, but as the plant grows care should be taken not to hoe too deeply. Tobacco which is grown under irrigation should be cultivated after each watering, as after "topping" the plant cultivation should cease.—C. J. Tregenna, Tobacco Expert.

The Detection of Crown Gall before Planting.

W. A. BIRMINGHAM, Assistant Biologist.

THE disease of fruit trees, known as crown gall, is likely to become serious if growers neglect to examine their trees closely before planting. The

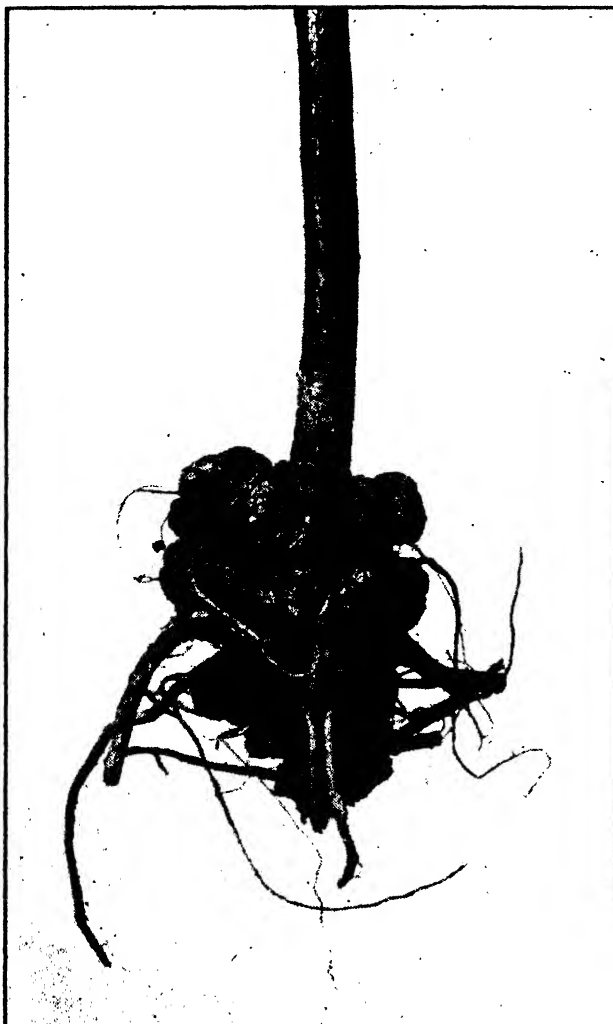


Fig. 1.—Crown Gall on Peach, at Bathurst.

accompanying illustrations are published in order that those who are purchasing trees may know what to look for.

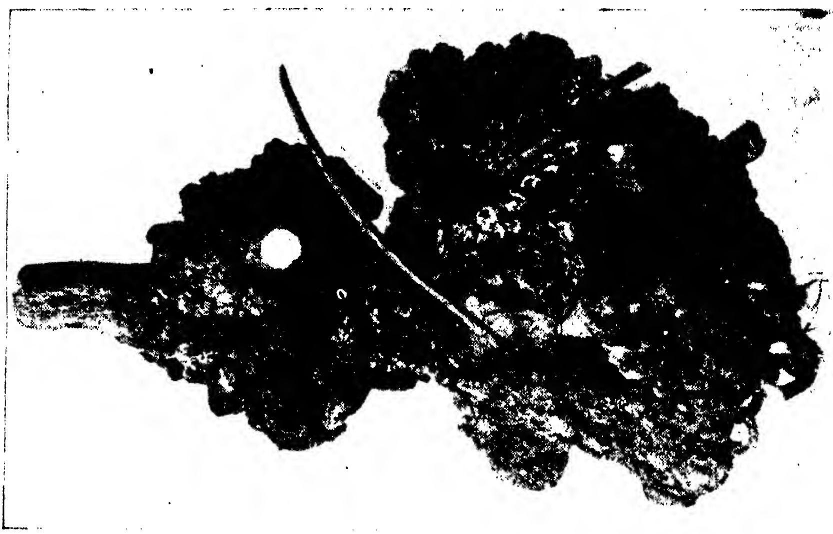


Fig. 3.—Crown Gall on Pear

Fig. 2.—Crown Gall on Quince Stock from France.

Every tree should be carefully examined before it is planted, and any that show any suspicious outgrowths near the crown or on the roots, should be rejected. This advice is offered to growers for three principal reasons:—

1. Crown-gall is often present on nursery stock. In most cases infection takes place in the nursery.
2. No successful control measures are known for the disease. Experiments have shown that cutting out the galls and treating with various germicides fail to arrest the development of the galls.
3. A case recently came under our notice in one nursery where 50 per cent. of the peach stock were badly infected (see Fig. 1). All the stock was destroyed.

When the galls have reached the size shown in Fig. 1, they can easily be detected by the grower, but in many cases the galls are not larger than a pea, and could be easily overlooked if the trees were not carefully examined.

Fig. 2 shows infected quince stock which arrived in this State from France. Needless to say the consignment was condemned and destroyed.

Fig. 3 shows a huge gall on a pear tree. It measured 8½ inches in diameter at the base, and 10 inches from the butt to the bottom of the gall.

A leaflet entitled "Crown-gall of plants" can be had on application to the Under-Secretary and Director.

Legumes that needed Nitrogen.

Although crops such as peas and beans have the faculty, in common with other legumes, of extracting nitrogen from the air, there are circumstances in which a nitrogenous fertiliser may be applied with good effect. "For twelve or fourteen years I have grown peas during the winter, and they used to produce marvellous crops," wrote a farmer in the Liverpool district recently. "I never used any manure, as they were inclined to grow too much foliage in a good season, but during the last four years they have gradually gone from bad to worse, and the farther from the top of the hill they are the less they thrive. I have tried superphosphate with no noticeable effect. The land is always fallowed in the summer. The spreading of fresh fowl manure along the tops of the rows after the plants are up has always had a markedly good influence on their growth. As there is a liberal precentage of ammonia in fowl manure, would a dressing of ammonia be advisable?"

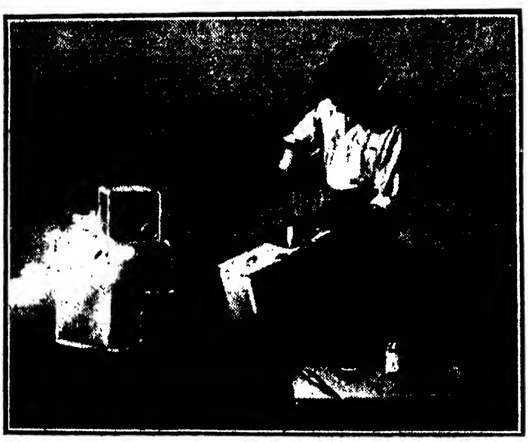
The writer was advised that the results from the use of fowl manure certainly indicated the necessity for a nitrogenous fertiliser, more especially in view of the fact that applications of superphosphate had been ineffective. The use of either sulphate of ammonia or nitrate of soda, both of which supplied nitrogen in a water-soluble and quickly available form, was recommended. The application in either case should be at the rate of 1 lb. to each 50 yards of drill in the form of top-dressing, care being taken to keep the fertiliser an inch or two away from the plants. The application of the fertiliser with the seed was inadvisable, as there was risk of interfering with germination.—A. J. Pinn, Inspector of Agriculture.

Soldering Work on the Bee Farm.

W. A. GOODACRE, Senior Apiary Inspector.

THE practical apiarist will find it very advantageous to be something of a handy man with tools, and a knowledge of soldering is especially useful, for a fair amount of soldering work is necessary at times in connection with honey containers and tanks, and vessels used in the treatment of honey.

The materials necessary for soldering work are one or two soldering irons (about 1 lb.), a quantity of reasonably soft solder, a bottle of muriatic acid (spirits of salts), and a small block of sal ammoniac. A handy container for the fire in which to heat the irons can be made out of an empty benzine tin or oil drum, by cutting out the top, punching a few holes in the bottom and cutting a hole in the side within an inch or so of the bottom, so that the heads of the irons can be passed through into the fire. To prepare to solder, pour into a bowl (glass or ware—not tin or galvanised iron) a quantity of the spirits and add a few pieces of zinc to "kill" the liquid. Some pieces of old zinc queen excluder are usually available about a bee farm, but where no zinc is available, water may be used for the same purpose.



The soldering iron is first heated to a dull red heat, a fair portion of the point is filed clean, and this portion (while the iron is still hot) is rubbed with the sal ammoniac. The clean point is then tinned—that is, coated with solder, and this is of great importance if good work is to be performed later. To tin the iron, run a little solder on to a piece of clean tin, alternately turning its point in the melted solder and dipping it in the killed spirits.

Before using the soldering iron clean the joint to be soldered, and with the aid of a brush put on a little of the killed spirits. The iron should be hot enough to make the solder run freely, but do not let it get red-hot. Withdraw it from the fire, brush the point with a piece of bagging, and dip it in the prepared spirits; then place the point of the iron on the joint to be soldered and move it slowly along, supplying solder as required by placing the end of the solder stick against the iron near the point. When soldering a loose patch, it will be found convenient to run a drop of solder on to the joint first, then hold the patch firm with the aid of the solder stick while the iron is operated to make the patch firm. The edges of any joints to be soldered should be fitted neatly and closely together, and the solder should run freely and adhere almost as if it were part of the tin.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT.

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Maize:—	
Wellingrove (formerly Early Yellow Dent).	Manager, Experiment Farm, Glen Innes. J. S. R. Crawford, Emu Swamp, Orange.
Golden Nugget...	J. W. Smith, Wauchope.
Craig Mitchell	W. D. K. Humphries, Muswellbrook.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy (formerly Improved Yellow Dent)	D. J. Dorward, Tayfield, Cundletown. J. C. Duff, Mount George. P. Mooney, Dumaresq Island, Taree. W. Richardson, Dumaresq Island, Taree.
Grain Sorghums:—	
Feterita	W. D. K. Humphries, Muswellbrook.
Manchu Kaoliang	Manager, Experiment Farm, Bathurst.
Millet:—	
Japanese	Manager, Experiment Farm, Coonamble.
Sudan Grass:—	J. Cavanagh, Curlewis. Manager, Experiment Farm, Wagga. Manager, Experiment Farm, Cowra. Manager, Experiment Farm, Bathurst.
Clovers:—	
Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
Kikuyu Grass:—	Principal H. A. College, Richmond. Manager, Experiment Farm, Lismore. Manager, Experiment Farm, Grafton.
Elephant Grass:—	Principal, H. A. College, Richmond. Manager, Experiment Farm, Lismore. Manager, Experiment Farm, Grafton.

In addition to those tabulated a number of crops were inspected and passed, but as the growers failed to forward samples their seed has not been listed.

CHALCID WASPS AND LUCERNE SEED.

REPORTS indicate that an impression exists that the chalcid wasp parasite of the sheep-maggot fly (*Nasonia brevicornis*) is identical with the wasp which infests lucerne seed, and it is very important that this misconception should be corrected. There are thousands of different chalcid wasps. The bulk of them are parasitic on other insects, but others make plant tissue their host (resulting in the formation of galls), and still others infest seeds. The wasp which destroys lucerne seed is a minute phyllophagous chalcid wasp, (*Bruchophagus funebris*) introduced from America some years ago, and since spread to a number of lucerne districts. It causes damage by laying its eggs within the seed. It is understood that some sheep-owners have hesitated to use the chalcid wasp parasite distributed free of charge by the Department, fearing that in this way they might introduce the species which is parasitic upon lucerne seed, but it will be seen that such fears are quite groundless.—W. W. FROGGATT.

Poultry Notes.

December.

JAMES HADLINGTON, Poultry Expert.

As in October notes, when we took a retrospective view of the hatching season then just brought to a close, it might be profitable now to review what is taking place in rearing the young stock, and incidentally to bring before readers faults and mistakes that have been made so far this season.

To one taking a bird's eye view of the whole poultry-raising position, the errors into which many novices fall stand out in sharper perspective than they can possibly do to the individual operator engaged in the work. First, then, it is a well-known fact which scarcely needs stating that early hatched chickens invariably do much better, develop quicker, and give a better return for the expenditure of food upon them than is the case with the later hatched birds. There are causes for this which we will do well to examine. The probable natural factors are (1), that, while there will be a higher percentage of infertility in the eggs set, the vitality of the chickens hatched is likely to be higher than from eggs laid towards the end of the season after a heavy laying period; (2) the ground over which the early chickens are run on any well regulated farm would be cleaner after the rest it has had between the one hatching season and the other; (3) there are less chickens to be attended to early in the season. Taken altogether the general conditions and environment are much better for early chickens than for later ones. In most cases, the latter have to be run over the same ground as the earlier ones have occupied, and in consequence there is doubtless an accumulation of parasitic life and organisms, such as coccidium, aspergillus and other forms of germ life that are inimical to chicken life, which constitute a handicap to rearing chickens toward the end of the season.

Disinfecting versus Cleaning.

In this regard the poultry farmer is constantly being reminded by the literature he reads of the necessity for cleanliness, disinfection, and sanitation, until it is a case of becoming deaf to the cry of "Wolf, wolf." This advice has not been unduly stressed in these notes, for the reason that the misuse of disinfectants has probably caused more troubles among chickens than their non-use. But what it is desired to stress is not disinfecting so much as strict attention to the cleaning up of droppings, the prevailing idea among poultry men being that it is easier to disinfect than to clean up. This is a fallacy, because of the temporary effect of disinfectants when applied to poultry houses, and particularly to heated brooders or where chickens congregate in mass. It is absolutely essential that the brooder boxes, or other arrangements serving their purpose, be cleaned daily, because it is there that

the most danger of the propagation and spread of coccidium exists. When it is understood that the droppings are practically the only source of infection, the cumulative effect of this organism will be apparent. It will also be understood how this disease becomes so troublesome towards the end of a rearing season.

Disposition of Young Stock.

It is feared that on many farms there is a slackness with regard to the arrangement and disposition of growing stock which is calculated to, and often does, ruin all prospects of securing proper development in late stock. As a consequence there is a tailing off of the young stock at the end of the rearing season to such an extent that it is questionable if half of them ever make profitable units.

Often this condition of things is brought about, in the first place through over-hatching—that is to say, bringing out more chickens than the equipment provided for their accommodation will take. Following upon this, there is a disposition to hurry the youngsters through the brooding and rearing stages on to the adult quarters altogether too fast. For instance, one often sees in the rearing pens or colony system chickens that should still be in the brooders, where they can get more concentrated attention and where conditions are suited to their tender age, while those that should be still in the rearing pens are found out in the adult quarters. The idea apparently is to finish up the rearing season and get rid of the intensive attention that would otherwise be necessary if sound methods of rearing were followed. The plea generally set up by the farmer to excuse himself is that the weather being warmer there is not the same necessity for keeping chickens to their allotted spheres as there is earlier in the rearing season.

Three Stages of Rearing.

As late as May last, attention was devoted in these notes to the necessity, as far as practicable, of keeping each age to the equipment designed for and allotted to it. These were set out as follows :—Six weeks in the brooders, up to ten or twelve weeks in the rearing pens, and from that age onwards in the colony enclosures until practically grown.

But what one finds is that as the warm weather approaches the chickens are hurried from one stage to another faster than is advisable or necessary, and the result is a tailing out to a lot of weedy, ill-conditioned specimens, which fall victims to any ailment that happens to be prevalent, or to constitutional weakness brought about by the struggle for existence under such adverse conditions.

It is felt that if beginners would follow as nearly as practicable the advice tendered in these notes, and in the literature issued from this Department, instead of adopting ideas that are not based upon sound experience, hundreds of thousands of chickens would be saved, and more profitable operations all round would result.

Care of Early Pullets.

Poultry-farmers will now be looking forward with some expectation to the early pullets coming on to lay, but it is not everyone who realises to the full extent how much the consummation of such expectations depends upon the treatment and general handling of the pullets—in other words, upon his own work and experience.

Pullets, and particularly those of the light breeds, hatched in July, should make a start to lay now very soon, and if properly housed and skilfully fed may be expected to continue to lay right up to April or even May, about which time they will usually fall into a partial moult or go off laying more or less during the following two months. However, the August-September pullets should follow on in their order and be a source of income during the months when only limited production is expected from the older hens.

Incidentally it might be mentioned that the same consistency in laying should not be expected as in the spring months. Nevertheless, whether they lay at all, or continue to do so, depends much upon the housing and general management of the pullets. A few hints on these matters may be of material assistance to the inexperienced.

To secure the best results it will be necessary to observe the following conditions:—(1) Do not house very young pullets in very large numbers; 50 is quite sufficient to put into one house; it matters not if the house will hold a thousand hens, stock just coming on to lay (unlike mature hens) are best kept in small numbers. (2) No change should be made in the ration to which they have become accustomed; any change that may be desired in this respect should have been brought about before the pullets commenced to lay; nor should they be moved from one place to another. (3) Regular and skilful feeding is very necessary to keep pullets in laying condition. For remarks under this head see " Poultry Notes" for November.

Risk of Disease.

It might be pointed out that any large aggregation of young stock, no matter how roomy the house may be, is almost certain to result in an epidemic of roup, catarrhal affection, chicken pox, or the like. Young stock should be kept in small numbers, and no changes in either position or diet should be made. By taking these simple precautions thousands of pullets that otherwise would not lay would become more or less productive over months when eggs are making the highest prices, so much depends upon the skill and attention bestowed upon them.

Clean Up.

Since experience of the last few years has shown that there are possibly but a comparatively small number of farms that are free from coccidium, it becomes more than ever important that a thorough clean up should be made immediately the chickens are out of the rearing equipment.

Preventive treatment consists in exposing all surfaces where chickens are run outside to the full effects of the sun and air. For this purpose all shading material that keeps the sun, wind and rain off the yard should be removed, and the ground left to spell under as clean and airy conditions as possible.

Floors, such as brooder house floors, whether constructed of concrete or wood, should be thoroughly washed or sprayed with a solution of 4 ounces of glycerine and 4 ounces of formalin to the gallon of water. This treatment of the rearing equipment has been found most effective in cleaning up this trouble, even where it has been bad right up to the end of the season.

In addition to this, where the disease has been diagnosed or is suspected, it is well to remove about 4 inches of earth from the brooder yards, leave it so until coming on next rearing season, then replace with new earth and ram down tight. Cultivation, or cropping, has no effect in the destruction of these organisms, and turning over the soil only assists in preserving them.

The Use of Sugar in Bordeaux Mixture.

The use of sugar in connection with copper salts as fungicides dates from about 1894, and it was mentioned several times in the next few years, but opinions varied considerably regarding the best amount of sugar to add. The prevailing opinion in the latter part of that decade appears to have been that the sucrose added should never exceed 15 per cent. of the bluestone used.

It will be noted that all this occurred long before the chemistry of Bordeaux (or Burgundy) mixture had been worked out, and when the general opinion was that copper hydrate resulted from the interaction of lime and bluestone; and it may be remarked that conclusions drawn from faulty and erroneous conceptions must necessarily be of little value. It appears to be extremely improbable that copper saccharate would be formed by the addition of sugar to copper sulphate in the quantities used for preparing Bordeaux mixture, but it is extremely probable that calcium-sucrate is formed, owing to the increased solubility of lime in a weak sugar solution as compared with water alone, and that this calcium-sucrate has a different action on the various basic copper sulphates present than has an aqueous solution saturated with lime. This last remark also obtains as regards the basic copper carbonate product in the preparation of Burgundy.

The addition of sugar to Bordeaux or Burgundy mixture has apparently gone out of general field practice, and better results are now obtained by the use of casein, 5 oz. being used to 50 gallons spray.—A. A. Ramsay, Principal Assistant Chemist.

Variegated Thistle as Material for Silage.

It is possible to make excellent silage from variegated thistle, the only difficulties in using the plant for this purpose being that it is very hard to cut, and awkward to handle. As it contains a large amount of moisture, it is an advantage to allow it to wilt for two or three days after cutting, before stacking or pitting. When fed green, this thistle sometimes causes poisoning, but I do not think there is any risk whatever of the silage proving poisonous. During the time it is in the pit (the method of ensiling recommended) the poisonous property seems to be destroyed.—A. H. E. McDonald, Chief Inspector of Agriculture.

Orchard Notes.

December.

W. J. ALLEN and S. A. HOGG.

FROM now on the successful development of the fruit crop depends to a very great extent on continuous cultivation, the effect of which is to check weed growth and retain the summer rains. Where possible, it is advisable to cultivate the orchard thoroughly after every fall of rain. If time cannot be found to use a spring-tooth cultivator, it would be an advantage to loosen the soil by using drag harrows rather than allow the surface to become encrusted. By using this implement a lot of ground can be covered in a short time, but, of course, it is not as beneficial nor as lasting as a cultivation 3 to 4 inches in depth.

Some orchardists have great difficulty in eradicating couch grass, and we are often asked the best method of dealing with this particular weed. It has been found from experience that the only period when this weed can be successfully dealt with is during the summer months. The ground should be ploughed so as to expose the roots of the plants to the sun, and after exposure for, say, a week, the surface should be cultivated so as to bring to the surface any roots which may have been covered. It will be found necessary to dig out plants that are growing in close proximity to the trees, and this should be done with a digging fork, care being taken to gather the whole of the plants (even the small portions which break off), and either burn or expose them to the heat of the sun so that they may be killed.

Thinning of Fruit.

There is every appearance that the summer fruits this year will be on the light side, and it may be thought that thinning will be rather superfluous, but there are always exceptions, and in going through an orchard one can invariably find some of the trees that are carrying an excess of fruit. A certain proportion of this fruit can now be removed with advantage.

This remark also applies to apple trees that bear in clusters. By removing some of the apples from these clusters, the orchardist can do better work with his spray, and the free penetration of light produces fruit of brighter and more attractive colour.

Summer Training.

This work has not up to the present been taken very seriously by the fruitgrower, but we would emphasise very strongly its great value, particularly at this time of the year. By judicious summer training, twelve

months in the growing period can be saved in many cases; that is to say, by the removal of superfluous young branches, and by the shortening in of laterals the flow of the sap can be diverted in the desired direction, thereby directly benefiting the branches that are to be permanently retained in the construction of the tree. These remarks particularly apply in the forming of young trees of two to four years old.

Spraying.

For such pests as codlin moth and pear and cherry slug, arsenate of lead should be applied in the proportions of from 2 to 3 lb. of arsenate of lead to 100 gallons of water. The exact proportion, of course, is regulated by the brand of arsenate of lead used. Leaflets regarding the use of arsenates of various brands may be had free of cost on application to the Under-Secretary and Director, Department of Agriculture, Sydney.

The pear slug does not confine its attacks to pears and cherries only, but may be found on other trees, which also should be sprayed with a view to killing the pest. It is not regarded as serious by some growers, but it may be pointed out that the full effect of the ravages of this slug in a cherry orchard may be a total lack of crop in the ensuing year.

Drying of Apricots.

Where it is desired that apricots should be dried, care should be taken to see that the fruit is well coloured and thoroughly ripe, as the weight of the fruit is governed to a very large extent by its sugar capacity, and the more sugar the apricot contains the brighter and more attractive its appearance. Having removed the stones, the halves of the fruit should be placed on clean wooden trays with the cups uppermost. They can then be subjected to the fumes of sulphur for a period of from three to eight hours, the period being regulated to some extent by the variety and conditions under which the fruit was grown. As a guide to the time required for fumigating, it has been found that when the juice has risen into the cups of the fruit the apricots may be removed, but at no period should they be left longer than eight hours. The riper the fruit, the less sulphuring it requires. The quantity of sulphur used is 1 lb. to every 300 cubic feet of space.

Manuring and Spraying of Citrus.

It will be found that at this period when the crop is developing it is an advantage to give the trees an application of artificial manure. Blood and bone may be used at the rate of from 2 to 10 lb. per tree, according to size and vigour. There are no trees that respond more to manuring than citrus, and if a grower neglects manuring or fertilising his trees he will soon see a marked falling off in his returns. It is found that the successful producer is the one who keeps his trees free from disease and liberally manured.

This cannot be too strongly emphasised. Success in citrus culture depends on the care and attention of the grower to his trees.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1922.

Society.	Secretary.	Date.
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Central Cumberland A. and H. Assoc. (Castle Hill)...	H. A. Best ...	,, 10, 11
Coramba A. Society	H. E. Hindmarsh	,, 14, 15
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Dapto A. and H. Society	J. T. Geeson ...	,, 17, 18
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Tenterfield A. Society ...	E. W. Whereat ...	Feb. 28, Mch. 1, 2
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Oberon A. P. and H. Association	C. S. Chudleigh ...	,, 2, 3
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